FAA-E-2594a
July 1, 1976
SUPERSEDING
FAA-E-2594, dtd 8/1/75

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
SPECIFICATION

AN EXPANDED ARTS IIIA SYSTEM

FOR THE NEW YORK TRACON

FAA-E-2594a
July 1, 1976

DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION SPECIFICATION

SPECIFICATION FOR AN EXPANDED ARTS IIIA SYSTEM FOR THE NEW YORK TRACON

1.0 INTRODUCTION - This system specification describes the requirements to be met in providing an expanded ARTS IIIA for the New York TRACON. This is an initial capability which will meet the immediate New York TRACON air traffic control needs. It also affords the broader automation base required for the addition of automation enhancements necessary to meet future operational requirements.

1.1 Scope - The New York Common IFR Room (NYCIFRR) currently located at John F. Kennedy International Airport (JFK), Jamaica, NY, has IFR control responsibility for aircraft operating at airports in the New York Metropolitan area. Its area of responsibility covers the area of approximately 40 miles of JFK within which over 1.2 million IFR operations occur annually. An ARTS IA radar and beacon tracking and alphanumeric display system couples two airport surveillance radars to 21 controller displays. Increasing operational requirements dictate that the present facility be functionally enhanced, expanded and relocated to Hempstead, NY. The new facility, to be called New York TRACON, is to be furnished an ARTS IIIA system. The system will process and track primary and secondary radar (beacon) derived aircraft data and display it on an air traffic situation display together with broadband video. The processed data will be automatically and semi-automatically displayed in the form of symbology and alphanumerics representing aircraft position, identification, Mode C pressure altitude, target velocity and radar beacon code readout. The system permits the operator (air traffic controller) to enter or retrieve data and selectively display, alter or delete data consistent with operational needs. In addition, it will provide the capability for intra-facility communication of stored

and active air traffic control information as well as data/message interchange with ARTCC computer systems. An on-line capability to generate and control simulated aircraft targets for training purposes will also be available. The principal functional capabilities will include but not be limited to:

(a) Processing, tracking and display of all primary and secondary radar video from four ASR systems on 37 TRACON displays and on seven remote BRITE alphanumeric displays.

(b) Fault detection and isolation.

(c) Fail-soft, i.e., continued automation operation at levels consistent with system availability when one or more system elements have failed.

(d) Capability for continucus recording of input, output and system status data.

(e) Capability for further functional growth and increased capacity.

(f) Capability for twenty-four hour daily operation in support of operational requirements.

(g) Capability for further modular expansion of hardware and software.

(h) Capability for full assembly and system support.

This specification and referenced documents in Section 2 provide the minimum requirements for the design, manufacture and testing of the data processing subsystems and all the ancillary equipments necessary to interface with the Government Furnished Equipment (GFE) in order to provide a fully integrated and operating system.

Software programs in the form of operational programs, utility and support programs, maintenance and

diagnostic programs and system test programs are also specified.

2.0 APPLICABLE DOCUMENTS

2.1 Government Documents

2.1.1 FAA Specifications - The following documents, including all revisions and amendments, in effect on the date of invitation for bids or request for proposals, form a part of this document and are applicable unless an exception is stated or to the extent specified herein.

FAA-E-2591	Automation Equipment, General Hardware Requirements for Automated Air Traffic Control Systems
FAA-E-2593	Specification for ARTS IIIA Improvements to the Modularly Expandable ARTS III Beacon Tracking Level System
FAA-TD/S-120-801A	Specification for Modularly Expandable ARTS III (TRACON "C") Beacon Tracking Level System and Spec Changes 1, 2, 3, 4, 5, and 6
FAA-G-1210	Identification & Cataloging of Replaceable Parts
FAA-C-1217c	Electrical Work, Interior
FAA-G-1375	Spare Parts Peculiar for Electronic, Electrical & Mechanical Equipment with FAA Parts Peculiar Replacement Table
FAA-G-2100/*	General Requirements for all Equipment
FAA-G-2100/1	Part 1, Basic Requirements for

	all Equipment
FAA-G-2100/3	Requirements fcr Equipments Employing Semi-conductors
FAA-G-2100/4	Requirements for Equipments Employing Printed Wiring Techniques
FAA-G-2100/5	Requirements for Equipments Employing Microelectronic Devices
FAA-S-2217	Digital Communications System Service
FAA-S-2258	Digital Data Communications System Service
FAA-E-2390c	Radar Microwave Link System
FAA-D-2494/1a	Instruction Book Manuscripts Technical: Equipment and Systems Requirements, Part 1, Preparation of Manuscript
FAA-D-2494/2a	Instruction Bock Manuscript Technical: Equipment and Systems Requirements, Part 2, Preparation of Manuscript Copy and Reproducible Artwork
FAA-E-2552	Technical Training

2.1.2 FAA Standards

FAA-STD-001a	Color and Texture of Finishes

---

*Specifications FAA-G-2100/1, FAA-G-2100/2, FAA-G-2100/3, FAA-G-2100/4 and FAA-G-2100/5 are referred tc hereafter as FAA-G-2100.

	for National Airspace System, with Amendment 1
FAA-STD-002	Engineering Drawings
FAA-STD-007	PERT Procedures for Contract Use
FAA-STD-010a	Graphic Symbols for Digital Logic Diagrams
FAA-STD-012a	Paint Systems for Equipment
FAA-STD-013a	Quality Control Program Requirements

2.1.3 FAA Publications

NAS-MD-601	Interface Control Document
NAS-MD-602	ARTS III System Shakedown
NAS-MD-603	Joint Acceptance Inspection
NAS-MD-604	Introduction to Specification Series
NAS-MD-605	Executive Control
NAS-MD-606	Beacon Message Processing
NAS-MD-607	Beacon Target Processing (Tracking)
NAS-MD-608	Keyboard Input Processing
NAS-MD-609	Display Output Processing
NAS-MD-610	Interfacility Data Transfer
NAS-MD-611	Bulk Store Flight Plans
NAS-MD-612	ASR-37 Error and Status Messages

NAS-MD-613 Adaptation

2.1.4 FAA Instruction Books

2.1.4.1 Air Traffic Control Beacon Interrogator (ATCBI)

(a) ATCBI-4, FA-8470; TI 6360.12

(b) ATCBI-5, FA-9400

(c) MX-8737/UPX Interference Blanker. Technical Manual TM/NAVELEX 0967-426-5010

2.1.4.2 Bright Radar Tower Indicator Equipment (BRITE)

(a) BRITE-I, FA-7847

(b) BRITE-II, FA-8178; TI 6410.3

(c) BRITE-IV, FA-8959

2.1.4.3 Remoting Equipment

(a) 2400-bit-per-second Data Set, FA-8880; TI 6350.4

2.1.4.4 Airport Surveillance Radar (ASR)

(a) ASR-7 FA-8200 through 8270, TI 6310.4A

(b) ASR-8 FA-9335 through 9345

(c) ARTS Common Equipment Assembly, FA-8762; TI 6410.9

2.1.4.5 Automated Radar Terminal System-ARTS

(a) ARTS-III, FA-8301 through 8317

(b) ARTS-III BRITE A/N Subsystem (BANS) FA-8340; TI 6310.9

2.1.5 Military Specifications - The following military publications, in effect on the date of invitation for

bids or request for proposals, form a part of this specification:

MIL-I-45208	Inspection system Requirements
MIL-E-17555	Electronic and Electrical Equipment and Associated Repair Parts, Preparation for Delivery of

2.1.6 Military Standards

MIL-STD-470	Maintainability Program Requirements for Systems and Equipments, 3/21/66
MIL-STD-471	Maintainability Demonstration
MIL-STD-721B	Definitions of Effectiveness Terms for Reliability, Maintainability, Human Factors, and Safety
MIL-STD-781	Reliability Tests, Exponential Distribution
MIL-STD-785	Requirements for Reliability Program

2.1.7 FAA Directives

6030.36B Preparation of FAA Form 6030.1, Facility Maintenance Log

6040.10 Equipment Failure Handbook

6190.1 EEM Handbook - ARTS System Equipment

6190.2 Maintenance of Automated Radar Terminal System (ARTS)

6360.1 Maintenance of Air Traffic Control Beacon

Interrogator (ATCBI) Equipment

6310.2 Maintenance of AirportSurveillance Radar (ASR) Facilities

6410.10A Maintenance of Bright Radar Indicator - Tower Equipment (BRITE)

2.2 ARTS III Enhancement Documents - The following documents contain design data and information representing the initial design approach for the Package I improvements. This design approach, both hardware and software, shall be used as a guide towards meeting the requirements set forth in this specification.

(a) Support Software Users' Guide, PX-6196

(b) IOP Multiprocessing Modification Design Data, PX-6361

(c) Design Specification for Display Buffer Memory Module, PX-7978

(d) Design Specification for Data Recording and Analysis System, PX-10091

(e) Design Specification for Augmented Radar/Beacon Tracking Level System, PX-7981

(f) Fail Soft Multiprocessor Executive Program Design Data, PX-7982

(g) Multiprocessor Executive Model Support, PX-10001

(h) Off-line Diagnostic Design Data, PX-10004

(i) Minimum Safe Altitude Warning Design Data, PX-11325

2.3 Industry Standards

EIA Standard RS-232

2.4 Precedence of Documents - When the requirements of the contract schedule, this document, or subsidiary applicable documents are in conflict, the following precedence shall apply. The contract schedule shall have precedence over all other documents. This document shall have precedence over all subsidiary applicable documents referenced herein.

2.4.1 Sources of FAA Documents - Copies of this specification and of the applicable FAA Specification Drawings may be obtained from the Federal Aviation Administration, Washington, D. C., 20591, attention: Contracting Officer. Requests shall fully identify material desired, i.e., specification numbers, dates, amendment numbers, complete drawing numbers; also, requests should identify the invitation for bids, request for proposals, or the contract involved or other use to be made of the material requested.

2.4.2 Sources of Military documents - Single copies of military specifications may be obtained from the Federal Aviation Administration, washington, D. C., 20591, attention: Contracting Officer; mail requests should cite the invitation for bids, request for proposals, or contract for which the specifications are needed; mail requests, if found acceptable, will be forwarded to a military supply depot for filling, hence ample time should be allowed.

2.4.3 Sources of Other Documents - Information on obtaining copies of Federal Specifications and Standards may be obtained from the General Services Administration Offices in Washington, D. C., Seattle, San Francisco, Kansas City, Missouri, Chicago, Atlanta, New York, Boston, Dallas and Los Angeles.

3.0 SYSTEM REQUIREMENTS

3.1 System Overview - The N. Y. TRACON system shall consist of contractor supplied and Government Furnished Equipment (GFE). Figure 6-1 presents a possible configuration of the N. Y. TRACON system. A data processing subsystem (DPS), consisting of Input/Output Processors (IOPs), Memory Modules (MMs), Central Memory Access (CMA) units and peripherals, shall perform,

among other automatic features, a tracking function which initiates and maintains the association of aircraft information with all beacon and primary aircraft. Broadband beacon and radar data from remote sensors shall be supplied to the Common Equipment and distributed via GFE switching equipment to the Radar Data Acquisition Subsystem (RDAS) and the Beacon Data Acquisition Subsystem (BDAS). The RDAS shall digitize radar data and transmit it to the DPS. The BDAS shall digitize beacon data and transmit it to the DPS. These data shall be used to declare targets which are used by the tracking function. An executive control program shall be provided to apportion the data processing load efficiently between the available processors. This program and its associated programs shall also sense when modules have failed, isolate them, provide appropriate failure and status information, then load and start an operational program which is most suited to the operable equipment which remains following the failure. Critical data recording shall be provided to improve the ability of the operational program to resume its functions following the detection of a failure and the reconfiguration of the system as a result of that failure. A system analysis recording capability shall be provided to continuously record data on traffic environment, system operation, and system utilization for later reduction and analysis.

3.1.1 Display Processing - The system shall display high quality alphanumeric characters on time-shared air traffic situation displays. The alphanumerics are used to present data in tabular lists and tags which are associated with displayed aircraft position symbols. These data include aircraft identity, beacon code, (converted mode C pressure altitude, computed ground speed and other information. Data for display in the TRACON shall be output via Display Buffer Memory Modules (DBMMs) which shall enable the displays to retain the capability of presenting the last alphanumeric and positional data during automatic reconfiguration and recovery. The DBMMs shall transfer (refresh) data to the Data Entry and Display Subsystem (DEDS) for display. A data entry keyboard shall permit entry and control of aircraft data, display characteristics and other functions. A trackball shall

be provided to enter pcsitional data.

3.1.2 Remote Facilities - Functions available at displays in the TRACON shall also be made available at remote tower displays. An Interfacility Communications Multiplexor (ICM) shall assist in providing this capability. A capability to exchange (transmit and receive) data with Air Route Traffic Control Center Central Computer Complexes shall be provided. The system shall alsc process flight data from a local storage device.

3.1.3 System Configuration - A Reconfiguration and Fault Detection Unit (RFDU) shall provide the capability for manually assigning any Memory Module (MM) to any number of IOPs. Each BDAS, at any given time, shall be assigned to one of at least two IOPs. The PSM shall provide switching of the BDAS broadband output to Government installed switching equipment instead of the DEDS as specified in FAA-E-2591a. This switching equipment will output the BDAS broadband video to selected DEDS (radar broadband to the DEDS shall be output from the GFE Switching equipment via the Common Equipment).

3.2 Equipment and Services to be Furnished

3.2.1 Equipment and Services to be Provided by the Contractor - The contractor shall provide the services and materials necessary to design, fabricate, modify, test, install, integrate, support and document the New York TRACON system as required by this specification. These shall be provided in quantities and at the times specified by the contract. The work to be performed shall include Government approved modifications, installation, and checkout of existing GFE as a part of the overall contractor system installation, integration and checkout efforts. The work shall also include equipment unit and subsystem interconnections, testing and demonstration of the ability of the integrated system to meet specified system performance requirements. The work shall be planned so as to assure efficient integration with on-going air traffic control operations. On-site work shall be scheduled and conducted so as to impose negligible impact on

on-going operational activities. In addition, the contractor shall provide all necessary services and material to prepare, reproduce and provide reports, computer programs and documentation as specified herein. Any feature or item necessary for proper operation in accordance with the requirements of the contract shall be incorporated even though that item or feature may not be specifically described herein.

3.2.1.1 Major Contractor Furnished Services and Equipment - All equipment and services shall be delivered and installed at the location specified by the Government. All facilities, parts and hardware, including system/subsystem grounding plates, receptacles, connectors, cabling, wiring, adapters, and outlets, except GFE facilities specified in 3.2.2, shall be provided to enable the components of each system to be assembled, interconnected and installed as required by these specifications. The major items of equipment and services to be furnished are:

(a) Data Processing Subsystem (DPS). This shall include IOPs and MMs in quantities adequate to support the system performance requirements specified herein. The DPS shall also include Central Memory Access (CMA) units as required.

(b) Radar Data Acquisition Subsystems (RDAS).

(c) Beacon Data Acquisition Subsystem (BDAS).

(d) Multiplexed Display Buffer Memory (MDBM).

(e) Interfacility Communications Multiplexors (ICM) and adapters.

(f) Beacon Control Units (BCU). Four of the eight BCUs shall be supplied without the set of cables connecting to the Beacon set.

(g) Reconfiguration and Fault Detection Unit (RFDU) and Peripheral Switch Module (PSM).

(h) The interfacing equipment between the GFE

Modems, GFE ERITE Alphanumeric Subsystems (BANS) and GFE keyboards at four Air Traffic Control Towers (ATCT's) to provide ARTS IIIA display outputs and keyboard inputs for six independent remoting systems.

(i) The interfacing equipment between the GFE keyboard and GFE MODEMS at the La Guardia ATCT.

(j) Medium Speed Printout Equipment.

(k) Break Point Modules.

(l) Disc subsystem.

(m) Magnetic Tape Unit.

(n) Console typewriters and adapters.

(o) Cables, bridging and isolation equipment necessary for interconnecting contractor supplied equipment, FAA installed equipment, and GFE with the new equipment. Installation shall be accomplished between a GFE interface unit (Demarcation Junction Box) and the new equipment. All wiring shall meet FAA-C-1217E specification requirements.

(p) The installation, cabling, and checkout of all TRACON Data Entry and Display Subsystem (DEDS) supplied as GFE, including the cabling to a designated location for connection of a spare DEDS.

(q) The installation, cabling, and checkout of six remote BANS and associated contractor furnished interfacing equipment.

(r) The installation, cabling, and checkout, of a BANS at the TRACON for the LaGuardia tower.

(s) The installation, cabling, and checkout of the GFE keyboard, the GFE modems, and the contractor furnished interfacing equipment at

the LaGuardia ATCT.

(t) The installation, cabling and checkout of the GFE Digital Sweep Generators (DSG's).

(u) All required AC power connectors for contractor provided equipment.

(v) Recommended size(s) of circuit breakers, primary power requirements and duct work to be furnished and installed by the Government.

(w) The contractor shall be responsible for the design of the grounding system. Where dissimilar metal contacts occur the design shall be based on FAA-G-2100, 1-3, 16, 24.

(x) Special Tools and Test Equipment.

(y) Operational Programs and Support Software.

(aa) Documentation.

(bb) Inspection of site preparation work prior to shipment of equipment.

(cc) System reliability, availability and maintainability program.

(dd) Quality Assurance program.

(ee) Module, Software and Systenn Testing in the factory and at the site.

(ff) Site installation and test plan.

(gg) Site Maintenance of all ccntractor supplied equipment and GFE TRACON DEDS during site installation and site test activities.

(hh) Site Maintenance during the period following completion of site installation and site test activities as required by the contract.

(ii) Recommended quantity and speeds of MODEMS

for interfacility and remote tower data transfers.

3.2.2 Government Furnished Equipment and Services - The Government will provide or install, or both, where applicable:

(a) FA-8762ASR Common Equipment and Video Switching and all cables connecting this equipment with other GFE equipment.

(b) TRACON Data Entry and Display Subsystems.

(c) MODEMS and Data links for data transfer between the N. Y. TRACON and remote locations. Radar microwave links shall be provided for four sensors. A T.V. microwave link shall be provided for one tower display (La Guardia).

(d) Demarcation Junction Boxes for connecting contractor equipment.

(e) BRITE and BANS and keyboard equipment for remote tower displays including cables between GFE equipment modules. The BRITE will be installed by the Government.

(f) BRITE and BANS equipment at the TRACON for one remote tower display (La Guardia) and all cable support and cabling between the La Guardia BANS equipment and the TV data link. The BRITE will be installed by the Government.

(g) All required AC power cable for GFE and contractor furnished equipment.

(h) AC power distribution panels with the number and size of circuit breakers specified by the contractor.

(i) All required AC power duct, conduit or other appropriate cable support from the GFE power panels to all GFE and contractor provided

equipment.

(j) Grounding wires from existing signal reference plates to all contractor and GFE equipments as necessary to meet the requirements of the grounding system. The grounding system shall be installed in accordance with the design supplied by the contractor and as shown in the approved Installation and Test Plan provided by the contractor. Grounding wires shall be terminated by the contractor to the contractors equipment.

(k) Cable ladder, duct or other appropriate cable support between the Demarcation Junction Boxes and the contractor provided equipment.

(l) All ducts, cable ladders or other appropriate cable support from the equipment room to the operating display consoles in the TRACON room.

(m) All cable ladder, duct or other appropriate cable support required at remote towers and at the N. Y. en route ARTCC.

(n) Air handling/conditioning that may be required to meet the environmental conditions specified herein.

(o) All floor space necessary.

(p) Drawings of the N. Y. TRACON, four remote towers, and data necessary for development of the system installation plan.

(q) Working space for contractor engineers which includes desks and access to telephones.

(r) Site parameter and system configuration data for software adaptation.

3.3 System Configuration - The New York TRACON system shall be similar to the Radar Tracking and Beacon

Tracking Level (RT&BTL) systems for sites having assembly capability as specified in FAA-E-2593a. The principal differences involve the radar and beacon target inputs from four ASR's, the number of displays and data entry sets, and the handling of peripheral devices. Figure 6-1 illustrates the four sensor New York TRACON system.

3.3.1 Sensor and Remoting Equipment - The expanded ARTS IIIA for the New York TRACON shall process and display information received from four Airport Surveillance Radar (ASR) and Air Traffic Control Beacon Interrogator (ATCBI) sensors. The sensors are located at the J. F. Kennedy, Newark, Islip, and Westchester County airports. The J. F. Kennedy and Newark airports have ASR-7/ATCBI-4 sensors. The Islip and Westchester County airport will have ASR-8/ATCBI-5 sensors. Each of these sensors will be remoted to the New York TRACON via a Radar Microwave Link system specified in FAA-E-2390c.

3.3.2 Data Acquisition Equipment - Each sensor shall interface with FA-8762 ASR Common Equipment and with the ARTS IIIA Data Acquisition Subsystems within the TRACON. A Radar Data Acquisition System (RDAS) shall be provided for each radar sensor. Two Beacon Data Acquisition Systems (BDASs) shall be provided for each beacon sensor. A Beacon Control Unit (BCU) shall be provided for each BDAS. Four Azimuth Distribution Units (ADUs) shall be provided for distribution of each sensor's azimuth data within the TRACON.

3.3.3 Data Processing Equipment - IOPs, MMs, and CMAs shall be provided as needed to meet system performance requirements.

3.3.4 Display and Data Entry Equipment - Multiplexed Display Buffer Memory Modules shall be provided for the purpose of transferring processed data to the Data entry and Display Subsystem (DEDS) and refreshing the displayed data. The system initially shall operate with 37 operational, maintenance, training and spare ARTS III DEDS. There shall be 18 vertical and 12 horizontal operational DEDS; 4 vertical maintenance DEDS; 1 vertical and 1 horizontal training DEDS and 2

vertical and 1 horizontal spare DEDS. Only one spare DEDS will be connected to the system at any time. All signal inputs to the DEDS, except DPS signals, shall be routed through a Government installed switching and distribution cabinet. The vertical DEDS shall be FA-8320 and the horizontal DEDS shall be FA-8321. The system shall initially operate with 84 Data Entry Sets located at the operational, maintenance, training and spare display locations. Each operational vertical display shall have two Data Entry Sets, each operational horizontal display shall have three Data Entry Sets, each vertical maintenance display shall have one Data Entry set, the vertical training display shall have two data entry sets and horizontal training display shall have three data entry sets. The spare DEDS connected to the system at the cable drop provided for it shall be capable of operating with 3 Data Entry Sets. The Data Entry Sets shall consist of the keyboard, trackball, and Quick Look Modules, FA-8330, FA-8331, and FA-8332, respectively.

A total of 39 DEDS and 87 Data Entry Sets will be provided to the contractor as GFE.

3.3.5 Tower Display and Data Entry Equipment - The system shall initially operate with 7 BRITE Alphanumeric systems (BANS), type FA-8340. One BANS, to be located at the New York TRACON, shall interface with a Government installed BRITE-IV. The mixed video will be remoted to the LaGuardia ATCT by a Government installed TV microwave link system. Two BANS shall be located at the J. F. Kennedy ATCT. Each of these shall interface with a Government installed BRITE II. Two BANS shall be located at the Newark ATCT. One of these shall interface with a Government installed BRITE I and the other shall interface with a Government installed BRITE II. One BANS shall be located at the Islip ATCT and one at the Westchester County ATCT where each shall interface with a Government Installed BRITE IV.

A BANS type Data Entry Set consisting of a FA-8349 keyboard and an FA-8350 Position Entry Module shall be located at each of the seven tower locations.

3.3.6 Peripheral Equipment - The system shall initialy

operate with the following peripheral equipment:

(a) Console typewriters located in the equipment room and the operations area

(b) A disc storage system consisting of controllers and disc drives

(c) Magnetic tape units

(d) Medium speed printers

3.3.7 Switching Equipment - A RFDU and a PSM shall be provided to enable assignment of any MM to any IOP, or paired BDASs to any of two IOPs. Additional switching equipment shall be provided for the Interfacility Communications Multiplexors (ICMs) to permit switching of the loads between ICM's.

Figure 6-1 illustrates the four sensor New York TRACON system.

3.4 System Functional Requirements - The system specified herein shall satisfy the functional requirements of ARTS III Beacon Tracking Level Systems and the requirements of the additional and/or modified functions described herein. These functions shall include but not be limited to ancillary functions, continuous data recording, radar target detection and processing, radar-beacon correlation and tracking, failure recovery and reconfiguration, multiprocessing, automatic overload sensing and protection, and remote tower display and data entry.

3.4.1 Ancillary Functions - The multi-processor executive, disc storage, magnetic tape and printing units will accommodate the conduct of support or ancillary functions concurrent with the execution of the operational program. These functions are enabled by manual input to control the data transfer between disc, magnetic tape and core memory storage devices. The following capabilities shall be provided concurrent with the operational prcgram and without derrogation to operational functions:

(a) Copying on magnetic tape selected portions of CDR data already recorded on disc.

(b) Copying on disc bulk store flight plan data already recorded on magnetic tape so as to enable its call up by the operational program.

(c) Loading into core memory and the exercising of utility, training and limited diagnostic programs and subprograms such as ETG, BRATS, TIMER, XEF, PCFA, and training scenarios.

3.4.2 Critical Data Recording (CDR) - The CDR function shall permit extraction of history and system data during the execution of the operational program and the recording of that data on a mass storage subsystem. Extraction and recording shall be continuous and uninterrupted and shall be capable of being edited, reduced and analyzed by an editor (Section 3.6.2.4). It shall also afford an on-line capability to transfer data from the mass storage subsystem (disc) to magnetic tape or from magnetic tape to disc. The extractor shall be modular to allow expansion of the data types that can be extracted and recorded. As a minimum, the capability to extract the data types listed below shall be provided:

(a) Radar Reply Data

(b) Radar Target Reports

(c) Beacon Reply Data

(d) Beacon Target Reports

(e) Correlatd Radar and Beacon Target Reports

(f) Tracking Data

(g) Automatic Functions

(h) Manually Entered Functions

(i) Display Data

(j) Interfacility Input and Output Data

(k) Remote Tower Data

(l) Error and Status Message Data

(m) Flight Plan Data

(n) System Utilization Data

(o) Sector Time

(p) Minimum Safe Altitude Warning (MSAW) Alarm Data

Selection of these data types shall be site adaptable. The capability of automatic initiation, alteration and termination, shall be provided on-line.

Automatic initiation of the extraction of all of the above or preselected data types at system startup shall be enabled. In addition an on-line capability to enable or inhibit extraction of any or all data types shall be provided.

Priorities shall be associated with recorded data so that in the event of data overload, low priority data will be discarded while maintaining high priority data. The function shall monitor its own operation and generate appropriate status and error messages. Status and error messages shall include, but not be limited to, termination and reinitiation of the extraction of data or data types, data overflow, changeover from one recording element to another, e.g., one disc drive to another disc drive and disc to magnetic tape unit, and CDR element failures.

3.4.2.1 Normal CDR Data Requirements - The CDR function shall provide the capability to record and store all of the data specified in Section 3.4.2 when called upon by the program or the operator. However, normal CDR data requirements on a routine daily basis will be:

(a) Tracking Data

(b) Radar Target Reports

(c) Beacon Target Reports

(d) Correlated Radar and Beacon Target Reports

(e) Central Track Store Files including MSAW

(f) Automatic Functions

(g) Keyboard Input Data

(h) Interfacility Messages

(i) Sector Time

3.4.2.2 Dynamic Selection and Filtering of CDR Data - An operator, via any keyboard shall be able to control which of the data types will be recorded. The operator shall also be able to terminate or initiate the CDR function. The following filters shall be provided for editing:

Extractor	Editor
(a) Sensor or Subsystem Number	(a) Senscr or Subsystem Number
(b) Azimuth Limits	(b) Azimuth Limits
(c) Range Limits	(c) Range Limits
(d) Altitude Limits	(d) Altitude Limits
(e) Display Number (Inhibit)	(e) Display Number (Selective)
(f) Beacon Code (Inhibit)	(f) Beacon Code (Selective)
	(g) Aircraft Identification (Selective)
	(h) Parameters Defining

Time Period Limits

The extractor filters, above, shall be site adaptable for automatic initiation as well as alterable on-line.

3.4.3 Radar Target Detection and Processing - The Radar Target Detection function shall accept radar video, azimuth, and timing inputs from an Airport Surveillance Radar (ASR) and use this information to generate a radar report for each detected aircraft target on each antenna scan. Radar reports shall contain target range, azimuth, and target run length in units of azimuth change pulses. They shall be stored in DPS memory in a suitable format for further processing by the Radar and Beacon Tracking Logic. The radar target detection function shall be implemented through the use of a special purpose hardware unit called the Radar Data Acquisition Subsystem (RDAS) in conjunction with a number of stored program routines collectively referred to as the Radar Input Processing (RIP) subprogram. The RDAS shall perform binary quantization of the radar video and shall send the resulting binary hit data in word format to the DPS. In addition the RDAS shall send to the DPS a pointer to areas containing clutter, and clutter correlation measurements. The RIP software shall accept the inputs from the RDAS and shall make use of these inputs to detect aircraft targets and to control the detection process.

3.4.3.1 Target Detection - The detection of radar targets shall be accomplished in four sequential subfunctions: quantization, video selection, predetection, and final detection. Final detection shall be performed in the DPS by the RIP software. The remaining subfunctions shall be performed by the RDAS.

3.4.3.2 Quantization - The RDAS shall contain binary amplitude quantizers for simultaneously thresholding two types of radar video. One type of quantizer, the normal quantizer, shall be employed in a clutter free environment and shall establish its threshold by employing a long time constant closed loop noise metering circuit. Another type of quantizer, the clutter quantizer, shall be employed in ground or

weather clutter environments. The clutter quantizer(s) shall employ an adaptive threshold technique to perform the binary quantization of the video in clutter areas. The output of the normal and clutter quantizers shall consist of range ordered 1/16 NM binary hits.

The normal quantizer shall accept linear or log normal video inputs. The clutter quantizer(s) shall accept log normal, linear MTI, or log MTI video.

3.4.3.3 Video Selection - The simultaneous thresholding of two or more videos can result in more than one binary hit being declared for each range cell. A video selection subfunction shall be performed by the RDAS to determine which video input, after quantization, shall be transferred to the DPS for each range cell. The selection shall be made by the RDAS on the basis of clutter map information received from the DPS (see paragraph 3.6.1.1.1.3). Selected hits shall be formatted in range order within 32 bit computer words for transfer to the DPS.

3.4.3.4 Predetection - The RDAS shall perform sequential azimuth integration on the selected hits which are at the same range cell but on adjacent radar sweeps. This sequential azimuth integration shall be used to generate a predetection pointer which shall indicate range cells where potential targets are present. The predetection pointer shall be transferred to the DPS and shall be used by the RIP software in the final detection process.

3.4.3.5 Final Detection - The RIP shall perform the final detection process by using the predetection pointer as an index to the selected hits which have been received from the RDAS. A detection window shall be positioned at the range and azimuth of the predetection and a target declaration shall be made when the sum of the hits in the window exceeds a threshold. The threshold shall be controlled dynamically by the RIP Software. Further processing shall be performed on detected targets to generate an estimate of target azimuth and run length.

3.4.3.6 Target Detection Control - Control shall be

exercised over the target detection process in order to maintain false alarm control while retaining target detection sensitivity. Four subfunctions shall be provided for target detection control: clutter intensity measurement, clutter mapping, clutter correlation measurement, and detection threshold regulation. The clutter intensity and correlation measurement shall be performed in the RDAS, whereas the clutter mapping and detection threshold regulation shall be performed by the RIP software.

3.4.3.7 Clutter Intensity Measurement - The RDAS shall contain logic to measure the clutter intensity on each radar sweep. After each radar sweep the RDAS shall transfer to the DPS a computer word which shall indicate areas along the sweep wherein there exist clutter levels with low intensity.

3.4.3.8 Clutter Mapping - The clutter intensity indication received by the DPS from the RDAS shall be processed by the RIP software to generate two stable maps indicating the following conditions: no clutter, and clutter. These maps, in conjunction with a manually entered ground clutter map shall be used to control the selection of hits for transfer by the RDAS to the DPS.

3.4.3.9 Detection Threshold Regulation - The clutter correlation indications received by the DPS from the RDAS shall be processed by RIP software to generate stable maps indicating various levels of clutter correlation. The clutter correlation maps shall be used to regulate the final detection threshold and if required, the quantization logic to insure proper false alarm control. Final detection threshold regulation shall make use of the existence of tracked aircraft in clutter free areas to enhance detection sensitivity.

3.4.3.10 Analog Display Output - The RDAS shall contain an analog output channel as specified in FAA-E-2591a.

3.4.4 Radar/Beacon Correlation and Tracking

3.4.4.1 Target Report Correlation - The Radar/Beacon

Correlation program shall search and compare beacon and radar report store data and shall pass each report through to the target report store, as a beacon only report, a radar only report, or as a merged report.

During the processing cycle an attempt shall be made to correlate available beacon reports with available radar reports. Successful correlation shall cause the radar report to be merged with the beacon report and the resulting merged report to be stored in the merged target report store. The merged target position shall be a weighted average of the beacon and radar report positions. Successful correlation is based on the distance between the beacon and radar target positions.

3.4.4.2 Tracking - The tracking program shall maintain the correct association between target reports and their corresponding alphanumeric data blocks. This association shall be maintained for both controlled and uncontrolled beacon and radar targets. Controlled targets are those tracks that have specific flight plan or controller entered identity data associated with them (e.g., ACID, ABC). Uncontrolled targets are those unused reports that are automatically initiated and tracked but not necessarily associated with a controlled track.

The tracking program shall be similar to the ARTS III Beacon Tracking Level program modified to operate under control of the multiprocessor executive with four sensors. The following functions shall be included:

(a) Radar Tracking

(b) Track-oriented smoothing

(c) Deviation scoring (nearest fit) logic to resolve ambiguity between one track and unassociated multiple reports in a bin

(d) Tracking of all aircraft (including auto-initiation)

(e) Deviation trial tracks for turn detection

(f) Tracking feedback to enhance radar detection

(g) Data point offset (upper firmness limit) logic to determine how heavily a correlated report's position should be smoothed

(h) A qualifying score to reflect each track-report relationship

(i) Automatic termination of control tracks (see paragraph 3.6.2.1.1.1.6) which shall include a minimum and maximum velocity criteria

3.4.5 Failure Recovery and Reconfiguration - A failure recovery and reconfiguration capability shall be provided. Hardware and software techniques shall be provided for the detection of equipment module failures or out of tolerance operation. Failure recovery and reconfiguration shall be accomplished automatically as well as by manual procedures or by a combination of automatic and manual procedures. The automatic recovery sequence shall provide that in the event of a second failure indication in the current operating level, another recovery shall be attempted without the use of critical data. Note: This will preclude the possibility of bad data in the data base causing continuous failures.

3.4.5.1 DPS Equipment-Module Failure

3.4.5.1.1 Failure Detection - Failures shall be detected by software and hardware techniques. Error detection shall include but not be limited to the monitoring of parity, memory resume, memory lockout, power, processor timeout, and illogical conditions.

3.4.5.1.2 Recovery and Reconfiguration Sequence - The recovery and reconfiguration sequence shall be automatic.

3.4.5.1.2.1 Scatter Interrupt - When a failure is detected, a scatter interrupt shall be generated which shall stop the operational program from cycling, force each IOP into its NDRO memory and initiate the recovery sequence.

3.4.5.1.2.2 Audible Alarm - A five-second audible alarm shall be provided for the operations room and also for the equipment room. The alarm shall have a volume control which shall allow an adjustment range of no perceptible sound to a maximum of 80 db SPL. The alarm shall be enabled at the start of the recovery sequence. The recovery alarm tone shall be clearly distinguishable from the MSAW alarm tone.

3.4.5.1.2.3 NDRO Recovery Program - Each NDRO memory shall contain a recovery program. This program shall test the IOPs and MMs to determine which are operative and can be used for loading the recovery module. NDRO shall also contain at least two bootstrap routines (e.g., disc and magnetic tape), one of which has been preselected for each IOP. The recovery module shall be called in by the lowest numbered operative IOP whose disc bootstrap has been enabled. If that load is unsuccessful, the second lowest numbered operative IOP with disc bootstrap enabled shall attempt the load and then the third lowest and so on until all have been tried. If all attempts to load the recovery module from the disc are unsuccessful, then the load shall be attempted by the lowest numbered IOP that has a UNISERVO VI-C tape bootstrap enabled and then second lowest and so on until all have been tried.

3.4.5.1.2.4 Recovery Module - The Recovery Module consists of software routines that conduct detailed checks on all DPS equipment modules. It shall determine which equipment module(s) are operable and then call in the highest level selected backup operational program that can operate in those modules. Startup of the backup operational program shall be automatic. A capability to manually preselect between two backup operational programs that utilize identical data processing resources shall be provided. The recovery module shall respond to the selection and load the proper backup operational program.

3.4.5.1.2.5 Failure Data - All failure data shall be output on a printer. Failure data shall include but not be limited to:

(a) An IOP and MM resources map

(b) The identity of the selected operational program

(c) All data presently required on the ARTS III fault log (NAS Documentaticn Form 7500-65) shall be printed out except data not accessable by the operational program.

(d) NDRO program failure indicators

(e) Recovery module failure data

(f) Time of failure

3.4.5.1.3 Program Storage - The capability to store operational and support software programs on the magnetic tape unit or a disc shall be provided. The capability to load software programs or segments thereof into the DPS from any available storage device shall also be provided. The latter capability must be provided so that subprogram load may be accomplished and executed while the cperational program is cycling.

The magnetic tape unit shall be the alternate program storage unit and shall be used when the disc subsystem has failed.

3.4.5.1.4 Critical Data - The operational program shall record critical data on the disc subsystem for use after a recovery and reconfiguration sequence. Critical data shall include but not be limited to the most recent track data, system configuration, systems data including time, selected beacon codes and software initialization parameters.

3.4.5.1.5 MM and IOP Partitioning and Isolation - An automatic and manual reconfiguration and partitioning function shall be provided to permit positive partitioning of all combinations of MMs/IOPs. In the event of an IOP or MM failure, the RFDU shall provide the necessary switching so that the failed element can be isolated from the operating system. The partitioning function of the PSM shall allow groups of off-line equipment modules to be connected together into working subsystems for maintenance or other

purposes. There shall be no interaction between off-line equipment modules and the on-line system except for shared use of peripheral devices.

When off-line equipment modules are manually switched on-line, there shall be no effect on the operating system until a manual input action is taken or a DPS equipment module failure occurs. The manual input action or the DPS failure shall cause the system to enter the recovery and reconfiguration sequence. The manual input command shall be capable of being entered from either the console typewriter or a DEDS keyboard. When the console typewriter is being used for entry purposes, output messages shall be retained for later printing.

3.4.5.1.6 Startup - The recovery and reconfiguration sequence shall be automatically entered for all operational program startups.

3.4.5.2 Disc Subsystem Failure

3.4.5.2.1 Failure Detection - Monitoring of disc subsystem operation shall include but not be limited to parity checks, timeout checks, reading of test patterns from write protected areas and the writing and reading of test patterns on other disc storage areas.

Two attempts to complete an operation shall be made. If the failure condition persists after the second attempt then a printout of the failure data shall be made.

Two attempts to complete the operation shall then be made through the alternate I/O channels. The operation shall be attempted sequentially on each channel until either a successful attempt has occurred or a failure has been encountered on all channels. Appropriate error message printouts indicating success or containing failure data shall be made.

If the attempts to complete the operation through the I/O channels have all failed, then the system shall test all disc drives to determine whether the malfunction resides in a disc drive and appropriate

failure data shall be output.

3.4.5.2.2 Automatic Reconfiguration - When a disc drive or controller failure has been detected, the operation shall be completed (when possible) by using another disc drive cr controller.

If a disc overload is sensed, an automatic switchover to another disc shall cccur.

3.4.5.2.3 Manual Reconfiguration - A capability to manually energize each individual I/O channel or all I/O channels together shall be provided on the controller. Input messages shall be provided to select which channel(s) and ccntroller(s) shall be utilized by the system.

3.4.5.3 Console Typewriter Failure

3.4.5.3.1 Failure Detection - Failure detection shall include but not be limited to parity and timeout monitoring. If a failure is detected, an attempt to complete the operation through an alternate console typewriter shall be made.

Console typewriter failure data shall be output on another console typewriter or on the medium speed printer.

3.4.5.3.2 Automatic Reconfiguration - The console typewriters shall be used as the principal output device for recording all error, failure and status information. When no console typewriter is available, these messages shall be output on the medium speed printer, so that no data is lost.

3.4.5.3.3 Manual Reconfiguration - A capability shall be provided to enter manual input messages from either the console typewriter or a DEDS keyboard to designate which of the console typewriters or MSP shall be utilized for the output of selected error, failure and status messages.

3.4.5.4 BDAS Failure

3.4.5.4.1 Failure Detection - BDAS failures shall be detected by a combination of hardware fault monitors in the BDAS which report failure indications to the DPS and by the operational software. Failure detection shall include but not be limited to range, azimuth, interlace, test target, parity and time-out monitoring.

Failures shall be declared whenever the error rate exceeds a predetermined threshold (SP).

Whenever a failure is declared, a printcut of the failure data shall be made.

3.4.5.4.2 Automatic Reconfiguration - Whenever a failure is declared, the DPS shall utilize data from the alternate BDAS. A printout of this actiсn shall be made. After automatic switching to the alternate BDAS, a check of normal BDAS failure parameters will be made. If a failure exists, a delay of N seconds (SP) will occur before switching back to the original BDAS. If after N sconds the failure still exists, the reconfiguration will operate as originally provided. Again, a printout of this action shall be provided.

3.4.5.4.3 Manual Reconfiguration - A capability to connect either one of a BDAS pair to either one of two IOPs shall be included. The switching shall be arranged such that the output of two BDASs cannot be connected together.

A capability to connect the DEDS to the BDAS analog signals from either one of a BDAS pair shall be included. A positive indication as to which IOP is receiving BDAS data shall be provided sc that the correct BDAS analog signals can be connected to the DEDS.

Manual input messages shall be provided to ccntrol IOP/BDAS operation. Messages shall include a capability to reinitiate the automatic reconfiguration mode and designate the IOP(s) that shall receive BDAS data. These manual input messages shall be capable of being entered from either the console typewriter or a DEDS keyboard.

3.4.5.5 RDAS Failure

3.4.5.5.1 Failure Detection - RDAS failures shall be detected by a combination of hardware fault monitors in the RDAS which report failure indications to the DPS and by the operational software. Failure detection shall include but not be limited to range, azimuth, RTQC test target, parity and timeout monitoring.

Failures shall be declared whenever the failure rate exceeds a predetermined threshold (SP).

A printout of the failure data shall occur whenever a failure is declared.

3.4.5.5.2 Automatic Reconfiguration - Whenever a failure is declared the DPS shall utilize data from the alternate channel. A printout of this action shall be made.

3.4.5.5.3 Manual Reconfiguration - Manual input messages shall be provided to control the IOP/RDAS operation. Messages shall include a capability to reinitiate the automatic reconfiguration mode and designate the IOP(s) that shall receive RDAS data. These manual input messages shall be capable of being entered from either the console typewriter or a DEDS keyboard.

3.4.5.6 MDBM and DEDS Failures

3.4.5.6.1 Failure Detection - Monitoring of MDBM and DEDS operation shall include but not be limited to parity, test messages, and timeout checks.

If a failure is detected, two attempts to complete the operation shall be made before a failure is declared and a failure data printout occurs.

When a failure is declared, two attempts shall then be made to complete the operation on the alternate channel and a printout indicating success or containing failure data shall be made.

No further special treatment of the error condition

shall be made except as directed by manual input messages.

3.4.5.6.2 Manual Reconfiguration - A capability to manually select I/O channels shall be provided on the MDBM.

A manual input message capability shall be provided that shall stop or restart display output processing or keyboard input processing for any selected DEDS. It shall be possible to enter these messages from any DEDS keyboard. Whenever a restart message is entered, the failure declaration sequence of Section 3.4.5.6.1 shall be enabled.

3.4.5.7 ICM Failure

3.4.5.7.1 Failure Detection - Mcnitoring of ICM operation shall include but not be limited to parity, test messages and timeout checks. If a failure is detected, two attempts to complete the operation shall be made before a failure is declared and a failure data printout occurs.

3.4.5.7.2 Automatic Reconfiguration - When a failure is declared, two attempts shall then be made to complete the operation on the alternate channel and a printout indicating success or containing failure data shall be made.

No further special treatment of the errcr condition shall be made except as directed by manual input messages.

3.4.5.7.3 Manual Reconfiguration - Manual input messages in conjunction with a switch operation shall be provided to direct IOP/ICM operation. Messages shall include a capability to reinitiate the automatic reconfiguration mode and designate the IOP(s) that shall operate with the ICM. These manual input messages shall be capable of being entered from either the consele typewriter or a DEDS keyboard.

3.4.5.8 Medium Speed Printer (MSP) Failure

3.4.5.8.1 Failure Detection - Failure detection shall include but not be limited to parity and timeout monitoring.

When an operation results in an error two attempts to complete the operation shall be made. If the failure condition persists after the second attempt then a printout of the failure data shall be made.

3.4.5.8.2 Automatic Reconfiguration - Two attempts to complete the operation shall then be made through the second I/O channel and a printout indicating success or containing failure data shall be made.

3.4.5.8.3 Manual Reconfiguration - A capability to manually select I/O channels shall be provided on the MSP. Three selections shall be provided: on-line, which activates both channels, an only channel zero active and an only channel one active. The operational software shall be capable of responding to these selections. An input message shall be provided to manually select which channel shall be utilized by the system if both channels are energized.

3.4.5.9 Magnetic Tape Unit

3.4.5.9.1 Failure Detection - Failure detection shall include but not be limited to parity and timeout monitoring. Failures shall be declared whenever the error rate exceeds a predetermined threshold (SP). A printout of failure data shall occur whenever a failure is declared.

3.4.5.9.2 Automatic Reconfiguration - No automatic reconfiguration shall be provided.

3.4.6 Multiprocessing - The IOP shall contain features specifically designed to provide an efficient multiprocessing capability. These features shall include but not be limited to:

(a) Memory lockout

(b) Relative memcry addressing

(c) Table access control

(d) Biased load and store

The multiprocessing executive shall meet the requirements of Section 3.6.1.1.1 and shall be designed to make maximum use of the IOP multiprocessing features to ensure that an efficient use of data processing resources is obtained when executing the operational program(s).

3.4.7 Automatic Overload Sensing and Protection - To assure sustained processing power for air traffic control priorities, the contractor shall furnish software capability to automatically sense and protect against primary radar data overload situations (e.g., radar malfunction/failure, jamming and intense weather echoes). When an overload situation occurs, radar data processing shall be discriminately and dynamically reduced in a manner assuring optimum operational capability. That is, radar processing shall be inhibited in those azimuthhal porticns of the scan where the input data rate is excessive. Those portions of the radar scan where the data rate is normal or low shall not be affected.

3.4.7.1 Keyboard Inputs - A DEDS keyboard input action shall be provided that will enable or disable this function. A teletype printout shall follow the action indicating the status cf the function.

3.4.7.2 Display Output - An indication of the azimuth segments wherein radar data processing is inhibited shall be presented on the DEDS.

3.4.7.3 CDR - A CDR output shall be provided each scan that radar data processing is inhibited. The output shall indicate which segments are affected. This output shall be considered as one of the Automatic Function data types.

3.4.8 Remote Tower Display and Data Entry - A capability to present a mixture cf broadband video and alphanumeric data on BRITE displays housed in Air Traffic Control Towers (ATCTs) located several miles

from the New York TRACON building shall be provided. A capability for entering manual input data (such as keyboard data) into the DPS from these remote towers shall also be provided.

3.4.8.1 Display Assignments - The Kennedy and the Newark towers shall each be provided with two independent sets of display equipments. The Westchester, the Islip and the La Guardia ATCTs shall each be provided with one set of display equipment.

3.4.8.2 Broadband Video - The broadband video for each of the ATCT displays (except for the La Guardia display) shall be obtained from the primary radar and beacon set located at the ATCTs airport. The broadband video for the La Guardia tower display shall be obtained within the TRACON from the Kennedy airport's primary radar and beacon set.

3.4.8.3 Alphanumeric Data - The alphanumeric data for each of the tower displays (except for the La Guardia display) shall be output from the DPS by means of the ICM (section 3.5.11) and sent over a serial data transmission link to the Remote Tower Display Subsystem (section 3.5.16). Only alphanumeric data that adds to, deletes from, or modifies the displayed information shall be output from the DPS.

3.4.8.4 Manual Input Messages - Keyboard Quick Look, and Position entry messages shall be output from the tower display positions, and sent to the DPS by means of the data transmission link and the ICM. The operational software shall respond to these messages as required.

3.4.8.5 La Guardia Tower Display Configuration - The La Guardia tower display shall be as specified in section 3.5.14. A T.V. communication link (GFE) shall be used to transmit the combined video from the New York TRACON building to the BRITE display in the La Guardia tower.

3.5 Equipment Module Requirements - The contractor shall provide the following equipment, as a minimum:

(a) Radar Data Acquisition Subsystem (RDAS)

(b) Beacon Data Acquisition Subsystem (BDAS)

(c) Disc Subsystem

(d) Reconfiguration and Fault Detection Unit (RFDU)

(e) Multiplexed Display Buffer Memory (MDBM)

(f) Input/Output Processor (IOP)

(g) Memory Module (MM)

(h) Central Memory Access Module (CMA)

(i) Beacon Control Unit (BCU)

(j) Interfacility Communication Multiplexor (ICM)

(k) Magnetic Tape Unit

(l) Medium Speed Printer (MSP)

(m) La Guardia Keyboard Interface

(n) Remote Tower Display Subsystem (RTDS)

(o) Console Typewriter

(p) Break Point Module (BPM)

(q) Card Reader Subsystem

(r) Peripheral Switch Module (PSM)

These equipment modules shall meet the requirements specified in the following sections.

3.5.1 Radar Data Acquisition Subsystem (RDAS) - Four RDASs shall be provided, one for each primary radar. Each RDAS shall be adjusted to match the characteristics of the primary radar set to which it is connected. The RDAS shall meet the requirements

specified in FAA-E-2591a.

3.5.2 Beacon Data Acquisition Subsystem (BDAS) - Eight BDASs shall be provided. Two shall be assigned to each of the four beacon sensors. Each BDAS shall be adjusted to match the characteristics of its assigned beacon sensor. The BDAS shall meet the requirements specified in FAA-E-2591a.

Cabinets (FA-8302), DC/DC Power Converters (FA-8307A) and AC/DC Regulators (FA-8308A) that meet the requirements of FAA-E-2591a shall be provided to house and power the BDASs.

3.5.3 Disc Subsystem - A disc subsystem shall be provided. The subsystem shall consist of two disc control units and four disc drives. The disc drives shall have two ports (channels) allowing each drive to be connected to the two controllers. The controllers shall have four I/O channels, allowing each controller to be connected to four IOPs. The disc subsystem shall meet the requirements specified in FAA-E-2591a.

3.5.4 Reconfiguration and Fault Detection Unit (RFDU) - A RFDU shall provide automatic configuration control of IOPs and MMs for the system, per the requirements of FAA-E-2591a. The RFDU shall have the maximum size memory module partitioning capability of sixteen memory modules and eight IOPs. In addition, there will be a manual switching capability to fully isclate a MM or IOP from the remaining system.

3.5.5 Multiplexed Display Buffer Memory (MDBM) - Ten MDBMs shall be provided. Each MDBM shall contain a full compliment of display buffer memory modules (DBMM's). Each DBMM shall be supplied with 2K memory installed. The MDBM shall meet the requirements specified in FAA-E-2591a.

3.5.6 Input/Output Processor (IOP) - The IOP shall meet the requirements specified in FAA-E-2591a.

Cabinets (FA-8301), DC/DC Power Converters (FA-8307B) and AC/DC Regulators (FA-8308B) meeting the requirements of FAA-E-2591a shall be provided to house and power the IOPs.

3.5.7 Memory Module (MM) - Sufficient MMs shall be provided to meet the data processing requirements of this specification. The Memory Module shall be 16,384 words of 32 bits each. Each memory module shall have a single access port, and a memory cycle time of no greater than 750 nanoseconds. The memory modules shall meet the requirements specified in FAA-E-2591a.

3.5.8 Central Memory Access Module (CMA) - The contractor shall provide the necessary CMAs to configure a DPS with sufficient capacity to meet the data processing requirements of this specification. The CMA shall provide for the interconnection of IOPs and MMs. The CMA shall meet the requirements specified in FAA-E-2591a.

3.5.9 Beacon Control Unit (BCU) - A BCU shall be provided with each BDAS. Four of the eight BCUs shall be supplied without the set of cables connecting to the Beacon set. The BCUs with the set of cables shall be connected to each of the four Beacon sets. The BCUs without the connecting cables shall be paired with each of the four BCUs with the connecting cables. It shall be connected to a BDAS to provide audible and visual alarms for emergency and radio failure situations, but shall not be connected to the beacon system. The BCU shall meet the requirements of FAA-E-2591a.

3.5.10 Interfacility Communication Multiplexor (ICM) - The contractor shall provide two ICMs. One ICM shall provide a backup capability for the other. Each ICM shall contain four Teletype Adapters (TTA), two Interfacility Communications Adapters (ICA) and eight Remote Tower Display Adapters. The ICM shall meet the requirements of FAA-E-2591a and shall be designed such that all loads may be simultaneously connected in parallel to both ICMs.

3.5.10.1 Maintenance Provision - It shall be possible to disconnect any one or more loads from either ICM.

3.5.10.2 Remote Tower Display Adapter (RTDA) - The RTDA shall provide a full duplex serial data interface between the Remote Tower Display Subsystem and the Multiplexor. It shall be capable of transmitting and

receiving bit rates of 2400, 4800 and 9600 bits per second. The RTDA shall be compatible with EIA standard RS-232 and MIL-STD-188C.

3.5.11 Magnetic Tape Unit - Two Magnetic Tape Units shall be provided. Each unit consists of one magnetic tape transport and one controller. The magnetic tape units shall meet the requirements of FAA-E-2591a.

3.5.12 Medium Speed Printer (MSP) - MSPs and controllers shall be provided. Each MSP and each controller shall meet the requirements of FAA-E-2591a.

3.5.13 LaGuardia Tower Keyboard Interface - One set of interfacing equipment shall be provided to interface a GFE BANS keyboard with a GFE modem at the LaGuardia tower. The equipment shall make the keyboard function at LaGuardia identical to the keyboard function at the other remote tower displays.

3.5.14 Remote Tower Display Subsystem - Six remote tower display subsystems shall be provided for the New York TRACON. The contractor shall supply all of the interfacing equipments for the GFE BANS, keyboards, and modems that comprise the remote tower display subsystems. The remote tower display subsystem shall meet the requirements as specified in FAA-E-2591a.

3.5.15 Console Typewriter - Three conscle typewriters shall be provided. They shall be ASR-37 teletypes or equivalent.

3.5.16 Reserved.

3.5.17 Break Point Module (BPM) - Two BPMs shall be provided and have the following functions: It shall be an 18 bit, 6 function switch selectable device that shall be capable of stopping the ICP in selected Store, Fetch or Instruction sequences and in address conditions of less than, equal or greater than a preselected 18 bit address. The BPM shall be capable of operation in any non-exclusive combination of the six conditions.

3.5.18 Card Reader Subsystem - A card reader subsystem

shall be provided consisting of a controller and card reader. The card reader subsystem shall meet the requirements specified in FAA-E-2591a.

3.5.19 Peripheral Switch Module (PSM) - The PSM shall provide manual configuration control of IOPs and peripheral equipment, per the requirements of FAA-E-2591a. BDAS switching and BDAS analog video switching shall be provided for four sets of BDASs. Peripheral switching is not required for an IMT, ICA, or CTA.

3.6 Software Requirements - Complete operational software (Section 3.6.1) and support software (Section 3.6.2) shall be provided. Software shall be based on mutually agreed upon FAA ARTS IIIA released software.

3.6.1 Operational Software - Operational programs (software) shall be similar to ARTS III and ARTS IIIA programs in that all logically independent functions shall be segmented into separate subprograms (tasks). It shall be possible to change, delete, or add to one or more subprograms without affecting the remaining (unchanged) portions of the operational program. All parts of an operational program must be relocatable within main memory.

Each functional task shall be executable by an IOP. Each functional task shall be capable of being incorporated into the operational program. Each task shall be capable of assembly independent of the executive and other tasks. A capability shall exist to modify, insert, or delete tasks without changing the executive or the unaffected tasks.

In order to handle four sensors, the operational programs may have multiple copies of some tasks. Additionally, a task may be operated multiply so that a single copy of a task may be associated with more than one sensor on peripheral device. The number of duplicate tasks and the frequency of operation shall be consistent with throughput requirements (see Section 3.10.4) and other requirements herein.

The operational software shall include:

(a) Full Capability Operational Program (3.6.1.1)

(b) First Backup Operational Program (3.6.1.2)

(c) Second Backup Operational Program (3.6.1.3)

Following system reconfigurations an interfacility "restore" message shall be transmitted to the ARTCC. This message shall result in the ARTCC restoring the interfacility/ARTS data base.

During normal operation, that is with all IOPs and MMs operating properly, the full capability software controls the system. At this time, this software is resident in main memory, and backup software and a copy of full capability software is on disc or UNISERVO VI-C. If, in the event of failures, or for any other reasons, there is insufficient properly operating hardware for full capability software operation, backup software shall automatically be placed in main memory and assume control of the system. When sufficient properly operating hardware again becomes available, full capability software shall replace the backup software for control of the system. This replacement shall be initiated by an input command.

In the event of a sensor failure, a capability shall be provided in all operational programs to reassign the DEDS associated with the failed sensor to the operating sensors in a predetermined manner (site adaptable). Further, all input processing of data from the failed sensor shall cease. This capability shall be activated in response to a manual input action.

The source program for all Operational Programs shall be the same. Through the use of the Assembler and the Builder, this source program shall be capable of being assembled into any of the types of Operational Programs mentioned above. Recursive and re-entrant coding techniques shall be available for use in both the Multiprocessor Executive and tasks.

3.6.1.1 Full Capability Operational Program - The full capability operational program shall be composed of a Multiprocessing Executive (3.6.1.1.1), functional

tasks, and a System Data Base (3.6.1.1.17). Functional tasks shall include:

(a) Beacon Input Processing (3.6.1.1.2)

(b) Radar Input Processing (3.6.1.1.3)

(c) Radar/Beacon Correlation (3.6.1.1.4)

(d) Radar/Beacon Tracking (3.6.1.1.5)

(e) Keyboard Input Processing (3.6.1.1.6)

(f) Display Output Processing (3.6.1.1.7)

(g) Automatic Offset (3.6.1.1.8)

(h) Interfacility I/O Processing, ARTCC (3.6.1.1.9)

(i) Bulk Store Flight Plan Processing (3.6.1.1.10)

(j) Continuous Data Recording (3.6.1.1.11)

(k) Time Out Processing (3.6.1.1.12)

(l) Thread Update (3.6.1.1.13)

(m) Output Message Processing (3.6.1.1.14)

(n) Critical Data Recording (3.6.1.1.15)

(o) Enhanced Target Generator (3.6.1.1.16)

(p) Interfacility Communication Multiplexor Data Processing (3.6.1.1.17)

(q) Ancilliary Software (3.6.1.1.18)

(r) Minimum Safe Altitude Warning (3.6.1.1.19)

3.6.1.1.1 Multiprocessor Executive - The Multiprocessor Executive is responsible for the operation of the IOPs and their peripheral devices.

During system operation, it shall control the execution of the Operational Program as well as detect system failures and implement recovery logic.

The executive shall be capable of being executed by any IOP. It shall have dynamic storage allocation capability for relative addressing to any 16,384 word MM. The executive shall be designed to operate in, and control system configurations up to, eight IOPs and 16 MMs.

Care shall be exercised so that the task workload shall be distributed among the computing processors and also so that highly interfacing tasks (memory fetch interference or simultaneous access to a given data item) shall not frequently be executed at the same time. This shall be achieved in the executive controlled system through the preplan of the parallelism among tasks. That is, the majority of tasks shall be prescheduled within a network of other tasks. This network, called a lattice, shall describe all tasks which are prerequisites for any given task and all tasks which are successors to the given tasks. Tasks scheduled via a lattice are called "planned" tasks. Tasks which have aperiodic scheduling characteristics are called "popup" tasks. A list of popup tasks entrance times shall be maintained and popup task entrance control performed accordingly by the Executive.

The executive shall provide the basic functions of system initialization, task scheduling, request, servicing, interrupt control, and system recovery (not otherwise handled by NDRO or off-line software). These functions are described below. To facilitate system growth or changes, executive functions may be added, changed, or deleted, even though some executive functions may share the same tasks and portions of the data base.

(a) System Initialization - The executive shall have the capability to initialize the system hardware and software for either an initial system start or a recovery restart (startover). Parts of the system

initialization function may be contained in the executive. Initialization shall be controlled by a single IOP.

(b) Task Scheduling - The executive shall provide for task scheduling for the dispatch of program control to tasks within the Operational Program. Two types of query shall exist within the scheduler: the popup query and the planned query. The popup query shall provide high priority entrance to tasks which are aperiodic or for which excessive overhead would exist if they were planned. The planned capability shall provide a number of lattice frameworks in which tasks may be placed so that entrance is dependent upon the prior completion of other tasks or the lapse of a given amount of time. Tasks may be scheduled as both a popup and a planned task. This feature will permit a task to be scheduled periodically and yet still provide a fast response for critical functions.

(c) Executive Services - The executive shall provide Executive Service Requests (ESRs) to the tasks. A set of ESRs shall be made available to tasks for the general capabilities of I/O control, scheduling control, privileged instruction execution, and normal task exit. The console typewriter handler shall provide an I/O message control capability for operator/task and operator/executive interface. Logical to physical I/O device assignments and their backups shall be site adaptable.

(d) Interrupt Control - The executive shall have an interrupt capability to control all levels of both interprocessor and intraprocessor interrupt conditions. There shall be two types of interprocessor interrupts. One type is for input/output and originates in the ESR routine, and the other type shall inform the non-initializing processors that the initialization is complete and to proceed

with normal task scheduling.

(e) Recovery - In the event of detection of a system error, the Recovery and Reconfiguration Sequence (3.4.5.1) shall be initiated. Portions of the function of recovery and reconfiguration may be contained in the executive.

3.6.1.1.2 Beacon Input Processing - The Beacon Input Processing (BIP) task shall accept and process replies from the Beacon Data Acquisition Subsystem (EDAS), correlate them on a sweep-to-sweep basis to detect targets, and store the declared target messages for use by the beacon/radar correlation subprogram. The beacon input processing tasks shall also monitor BDAS/BIP performance. Functionally, the beacon input processing tasks shall perform as per NAS-MD-606 except that BIP shall operate on a scheduled basis.

The input received from the BDAS for each sweep shall consist of an interrupt word, an initial word, and up to 30 reply words. The initial word shall be checked for reasonable azimuth, proper interrogation mode (mode interlace), and alarm bit setting. Alarm printouts shall be generated in case of failure or error conditions.

The reply words shall be used for correlation with previously received reply words for possible generation of target report messages. System parameters shall be used for determining firm targets, split targets, and ring-around conditions. Declaration of target shall result in the storage of applicable data in the beacon target report store for subsequent processing by the beacon/radar correlation subprogram. This data shall consist of range, center azimuth, mode 3/A code, mode C code (if present), validity field for each code, SPI bit, and, a weak/strong target indicator based on azimuth confidence. Mode C validity shall be checked at all times. A count of the interrupts received shall be maintained to determine the current Pulse Repetition Frequency (PRF). An alarm printout shall be initiated if the PRF is not within limits.

Receipt of an internal test target shall also be verified once each scan. A test target shall be located approximately 32 ACPs in a clockwise direction from 180 degrees at a range of 59 1/16 nautical miles.

3.6.1.1.3 Radar Input Processing - The Radar Input Processing (RIP) program shall control the RDAS/RIP interface. It shall process the RDAS data for the statistical detection and position reporting of radar target echoes. It shall additionally provide the control for the RDAS video channel selection, weather hit regulation, and other computer selectable operating parameters. The radar input processing program shall be capable of performing the following functions:

(a) Control the input of RDAS data into assigned storage areas. This data includes quantized target video hits, clutter monitor data, target predetection indicators, isolated hit data, radar antenna position, and RDAS status codes.

(b) Search the predetection data and perform statistical detection tests to declare target reports.

(c) Determine the range run length and center azimuth of detected targets.

(d) Eliminate radar reports in clutter areas when the total hit count from the target falls below an acceptable level.

(e) Assign report quality, merge reports from adjacent range cells, and pass completed reports to the beacon/radar correlation program.

(f) Correlate weather hit data on a sweep-to-sweep and scan-to-scan basis.

(g) Correlate clutter monitor data on a sweep-to-sweep and scan-to-scan basis. Generate quantizer select maps used to select RDAS quantizers. Provide for quantizer

selection on a 2-mile by 32-ACP zone basis.

(h) Output the zone control map which regulates the quantizer selection in RDAS.

(i) Transfer command words to the RDAS for selection of operating parameters.

(j) Monitor the RDAS and radar input processing program performance.

(k) Generate error alarms for abnormal conditions.

(l) Control the generation and positioning of the Realtime Quality Control (RTQC) test target.

(m) Control RDAS alarm indications.

(n) Provide overload sensing and protection.

3.6.1.1.4 Radar/Beacon Correlation - The Radar/Beacon Correlation Function shall combine a sensor's radar and beacon reports received from the same aircraft into one merged radar reinforced beacon report. The position estimate for the radar reinforced report shall be derived from a weighted average of the beacon and radar report position estimates. Radar/beacon correlation shall first be attempted prior to track correlation. Beacon reports which fail correlation on this first attempt shall be subject to another attempt at radar correlation within the track correlation logic.

A radar target report may be declared before its beacon correlative (if it exists) or vice versa for some sensors (e.g., DABS). For that reason some radar reports shall be held in the radar report store and some beacon reports shall be held in the beacon report store throughout additional processing cycles to assure that all report pairs that qualify are correlated. These additional cycles shall not exceed the expected time required to complete the correlative reports (a system parameter). If correlation has not been achieved in this time interval, the reports shall be inserted into the appropriate report store as a radar

only target or as a beacon only target.

3.6.1.1.5 Radar/Beacon Tracking - The Beacon Tracking Level (BTL) ARTS III tracker shall be modified to include the features described in the following sections. Among the added features shall be the capability of automatically initiating and terminating tracks on all aircraft within the ASR surveillance areas. In addition, modification to the correlation logic shall provide for the combination of radar and beacon reports from the same aircraft, improved cross referencing, deviation scoring, and improved turning track correlation. To improve tracking on turns the smoothing algorithm shall be modified to provide the capability for applying different smoothing criteria along and across the direction of track motion. The selection of smoothing parameters shall be made more adaptive. For primary targets a tracking feedback loop shall be established to improve the target detection sensitivity in the areas of predicted track position.

In addition, this program shall be capable of accepting inputs from four sensors simultaneously and tracking targets which exist within the area of coverage of one or more (up to four) sensors. To effect proper operation, there shall be a tracking link within the software which will allow proper controller symbols to be displayed for an aircraft being controlled at one position and being viewed, but not controlled, at another position regardless of the sensor associated with that position. The handoff of an aircraft between controllers associated with different sensors shall be operationally identical as when both controllers are associated with the same sensor.

3.6.1.1.5.1 Automatic Track Initiation - An algorithm shall be provided to initiate tracks automatically on all radar and/or beacon target reports. The automatic initiation logic shall apply a different scan-to-scan correlation criteria for radar reports, beacon reports with radar reinforcement, and beacon reports without radar reinforcement. The automatic initiation logic shall provide for the filtering of radar clutter and beacon fruit through the use of speed, direction, and run length criteria. Tracks will not be initiated on

primary only target reports which occur in areas defined as heavy clutter by the clutter mapping function.

3.6.1.1.5.2 Termination of Controlled Track Status - When a controlled track status is automatically or manually changed to uncontrolled (e.g., via the geography dependent feature of the tracker, or the track suspend or track drop keyboard entry) the appropriate uncontrolled track symbol shall be immediately associated with and displayed for that track. In addition, a velocity criteria shall be provided which shall automatically terminate a controlled track (change from controlled to uncontrolled status) when its velocity is not within parametric (site parameter) values.

3.6.1.1.5.3 Smoothing Improvement - The BTL ARTS III smoothing (correction) algorithm shall be modified to include the use of track-oriented smoothing (TOS). Track-oriented smoothing involves the rotation of the X-Y coordinate system to correspond with the direction of track motion prior to computing smoothed track position. The use of TOS adds the capability of using different alpha-beta smoothing parameters along the across track direction. An additional capability to be added is the ability to dynamically set the upper limits for the alpha-beta smoothing parameters.

3.6.1.1.5.4 Tracking Feedback - The tracking logic shall generate a range-azimuth gate around the predicted position of firmly established tracks which have been correlating with poor quality radar reports. If the gate is within a clutter free area it shall be used by the radar target detection logic to lower the detection criteria within the gate.

3.6.1.1.5.5 Improved Cross-referencing - The ARTS III cross-referencing scheme shall be expanded to include the use of qualifying scores to resolve ambiguous situations. The qualifying scores shall indicate numerically the relationship between each report and the track(s) with which it is eligible to be correlated. The qualifying score shall take into account report validity or quality, beacon code

agreement between report and track, garbled and emergency code conditions, and the type of track which is being processed for correlation.

3.6.1.1.5.6 Deviation Trial - The turning track logic shall be modified to include the formation of a deviation trial track in the specific case wherein no reports are found in a normal track's primary bin, but exactly one is found in its secondary bin with proper qualifying score. The deviation trial track's predicted position shall be formed by straight line predicting from a smoothed position formed from the report position and the normal track's predicted position. The deviation trial shall become a normal track after two successive correlations. The use of the deviation trial track shall eliminate the necessity of generating two turning trial tracks in the specific case described above.

3.6.1.1.5.7 Correlation Bin Size for Coasting Tracks - In the case wherein two reports of any type both exist in two different tracks' correlation bins such that an ambiguous situation results which is not resolvable either through qualifying scoring or correlation with other tracks, the two tracks shall be coasted but the correlation bins shall not be increased in size.

3.6.1.1.5.8 Deviation Scoring - In the case wherein more than one report is in a track's primary bin each with equal qualifying scores and none of these reports is associated with another track, deviation scoring shall be attempted to resolve the ambiguity. The deviation score is arrived at by computing the distance between each report position and the track predicted position, taking into account the relative errors in range and azimuth. The report with lowest score (smallest error-weighted distance) is correlated to the track.

3.6.1.1.6 Keyboard Input Processing - Data shall be input to the operational programs from each local or remote Data Entry. The input data from each data entry set shall consist of one Type 1 word (display console settings: range scale and off-centering) and three Type II words (keyboard data: quick look selection,

trackball coordinate changes, the data/function characters). Data Entry Set inputs may be transmitted via MDBM or, for remote tower positions, via ICM.

The Keyboard Input Processing program shall process all DEDS channel interrupts, respond to service requests from the ICM data processing function, preview all input messages, and process all operational function requests. Operational function requests relate to track control, flight data, display control, system parameters, system configuration, implied functions and enhanced target generation.

Keyboard input processing shall be as per NAS-MD-608 with the following modifications:

(a) Messages shall be added to control the Continuous Data Recording task and the Enhanced Target Generator task.

(b) Messages shall be added to control system configuration, initiate recovery sequence, load backup and standby programs and enable or disable the overload sensing and protection function.

(c) Messages shall be added to control RDAS operation.

(d) The Select (inhibit) Presentation of Single Symbols shall be expanded to allow control of the primary single symbols also.

(e) The current ARTS III keyboard functions of START TRACK and DROP TRACK shall be changed in concept because all targets shall be tracked. However, the software functions to initiate and associate flight data with a displayed target or drop it shall remain the same. The contractor shall make the necessary documentation changes and procure the necessary key covers to denote these functions as Initiate Control (IC) and Terminate Control (TC).

(f) Messages shall be added that shall result in the Display Output Processing task completely rebuilding the display data base in the DBMMs or the RTDS of the position entering the message.

3.6.1.1.7 Display Output Processing - The Display Output Processing function involves the preparation and transfer of data to the display buffer memory and the maintenance of the buffer memory P-stack (up to 64 words per display). The P-stack controls the transfer of data from the buffer memory to the display (refresh). Display Output Processing shall also prepare and transfer data to the ICM Data Processing function for the presentation of data on the RTDS(s), The display output tasks shall be divided into separate subroutines in order to effectively handle the variety of data to be presented and to meet the individual update frequencies required for the various data.

The data to be transferred to each display may be divided into seven separate categories:

(1) Active controlled aircraft (two or three line FDB or single symbol)

(2) Inactive controlled aircraft (tabular lists)

(3) Uncontrolled aircraft (LDB or single symbol)

(4) System data (alphanumeric)

(5) Keyboard Preview and Readout data (alphanumeric)

(6) Trackball position (symbol)

(7) Radar data processing inhibition indicators.

Display output processing shall be as described in NAS-MD-609 and the following: a. The virgule (/) shall be displayed to indicate uncontrolled primary radar only targets. b. Limited Data Blocks (LDB) for primary radar only targets shall display ground speed when requested by the cperator via slewball and enter

button. c. Displayed data are output via Display Buffer Memory Module which controls the refreshing of the displays. d. Displayed data are output to the RTDS via the ICM. e. Unique symbology for a minimum of 81 keyboard positions shall be provided. f. The System Data Area shall include the display of the operational program level.

3.6.1.1.8 Automatic Offset - The Automatic Offset function (selectable at each display by keyboard entry) shall attempt to minimize alphanumeric format overlapping at each display per NAS-MD-609, section 8

The active controlled track formats at each display shall be periodically checked to determine if format overlap exists. If overlap is detected, the offset of one of the formats shall be changed. Only the active tracks controlled at one display shall be considered. No attempt shall be made to prohibit an active track format from overlapping with uncontrolled track readouts, quick look tracks, handoffs tracks, tabular lists, preview data, or single symbols (representing other controlled or uncontrolled aircraft). Also, no attempt shall be made to prohibit crossing leaders. When the overlap condition no longer existss, the data block shall be returned to its initial position.

3.6.1.1.9 Interfacility I/O Processing, ARTCC - The Interfacility program shall input and process all data received from the ARTCC, and pack and output all messages to the ARTCC. These data and messages include flight data, track data and responses. The interfacility program shall be as per NAS-MD-610 and shall satisfy the requirements of NAS-MD-601, except that data shall be transmitted to and received from the ARTCC via the ICM data processing function.

3.6.1.1.10 Bulk Store Flight Plan Processing - The input of flight plan (FP) information from bulk store shall provide automatic initiation of aircraft records and controller/aircraft assignment for prestored (scheduled) aircraft. The FP input capability shall be an independent operational function with on-line operator control. The magnetic tape input may be used in conjunction with or without interfacility (ARTCC)

communication.

A capability to load the FP data, prestored on magnetic tape in time-ordered sequence, into disc storage shall be provided. The data shall then be taken from its storage element (tape or disc) validated, formatted, and processed per NAS-MD-611.

3.6.1.1.11 Continuous Data Recording - The Continuous Data Recording Functional Task shall extract radar, beacon and other data during execution of the operational program and transfer all or part of that data to an external storage device. The data shall be extracted and recorded continuously. The stored data shall be capable of being edited, reduced, and analyzed by an off-line editor (see section 3.6.2.4). The CDR function shall not adversely impact program timing.

The function shall include a capability to extract radar target data and/or beacon target data either at the input or output of the radar/beacon correlation function. Thus, extraction of all radar-detected targets, radar-only targets, unreinforced beacon targets and reinforced beacon targets shall be possible.

3.6.1.1.11.1 Data Types - The extractor shall have the capability to write on disc storage or on magnetic tape, as a minimum, the following input/output data types:

(a) Radar Reply Data (selectable by sensor)

(b) Radar Target Reports

(c) Beacon Reply Data (selectable by sensor)

(d) Beacon Target Reports

(e) Correlated Radar and Beacon Target Reports

(f) Tracking Data

(g) Automatic Functions

(h) Manually Entered Functions (keyboard)

(i) Display Data (note)

(j) Interfacility (input and output) Data

(k) Remote Tower Data (note)

(l) Error and Status Message Data

(m) Central Track Store Files including MSAW

(n) Flight Plan Data

(o) Sector Time

(p) MSAW Alarm Data

(Note: The data that is displayed in the tabular lists and the system data area.)

Nothing in the design shall preclude the later inclusion of other types of data, e.g., metering and spacing.

3.6.1.1.11.2 Data Loss Condition - The extractor shall place the desired data in a buffer area. When one buffer is filled, a record from that buffer shall be written on the designated recording media (disc or magnetic tape) while further extraction is continued and the data stored in another buffer. When the other buffer is filled another record shall be written. The buffer areas shall be used alternately/sequentially in this manner while the program is in operation.

In the event that a buffer area becomes full before another is available, i.e., recording is not completed, a "Data Loss" condition shall exist. This condition shall result in the following action:

(a) The program shall stop extracting data selectively on the basis of software adapted priorities. The data having the lower priority shall be deleted first. If deletion of more than one type data becomes necessary,

the next lowest priority data shall be deleted. Priorities shall be as follows:

(where the lowest priority has the highest number):

1. Sector Time
2. MSAW Alarm Data
3. Track Data
4. Target Data
5. Interfacility Input and Output Data
6. Manually Entered Functions (keyboard)
7. Display Data
8. Remote Tower Data
9. Reply and all other data

(b) A printout noting the time of data loss and the type of data no longer being extracted shall occur on the appropriate printer.

(c) Extraction of the suspended data shall be automatically reinitiated in priority order when the overload situation is cleared. A printout shall occur noting the time and type data being restored.

3.6.1.1.11.3 Automatic Initiation of Extraction - CDR shall be automatically initiated at system start up with the extraction of all or preselected data types. Selective extraction of specific data may be inhibited or enabled by keyboard entries. When the extractor is initiated automatically or manually, it shall write the data via the buffer areas on the designated recording media. When the area designated for writing data within a disc pack is filled an automatic transfer to the standby disc pack shall occur. When magnetic tape is used, it shall be manually initiated and continue

writing until it receives an end of tape interrupt or is manually switched. The extractor shall initiate the disc unit designated "available" (automatically or by manual switch action) and continue output on that element. When the end of tape or manual interrupt is received on the magnetic tape unit a tape mark shall be written on the tape and the transport shall rewind to BOT. Whenever a transfer from one recording element (disc, disc to tape or tape to disc) to another occurs, a message indicating the time and status of the extractor shall be output on the console typewriter, or MSP if so designated. If at any time, including initiation, interrupts are received from the designated disc indicating a failure or not ready, the extractor shall switch to the alternate disc. In all of the foregoing cases a message indicating time and extractor status shall be printed on the console typewriter, or MSP, if so designated.

3.6.1.1.11.4 Extraction Control - Operation of the extractor shall be program controlled except as modified by input messages from any DEDS keyboard having supervisory status. The operator shall be able to control data types, designate the recording media and enter the data.

The following filters shall exist and may be used in any combination:

(a) Sensor or Subsystem Number
(b) Azimuth Limits
(c) Range Limits
(d) Beacon Code
(e) Altitude Limits
(f) Display Number

The purpose of extractor filters is to reduce the amount of data to be recorded by screening out non-desirable information, e.g., display data output to a maintenance or other unused display normally need not be recorded. The filters shall be applied as follows:

(a) Sensor or Subsystem Number. A keyboard entry to inhibit or enable recording of data from either or both radar/beacon sensors shall be

provided.

(b) Azimuth Limits. A capability to enter up to 3 azimuths shall be provided. This filter shall be sensor oriented.

(c) Range Limits. A capability to enter up to 3 ranges shall be provided. This filter shall be sensor oriented.

NOTE: The azimuth and range filters working in conjunction shall enable the non-recording of data whose origin is beyond the boundaries described.

(d) Beacon Code. A capability to enter up to 5 beacon codes shall be provided. This function shall inhibit the recording of the data associated with these codes. This filter shall be sensor oriented.

(e) Altitude Limits. The capability to enter an upper altitude limit shall be provided. This function shall inhibit the recording of data whose origin is above the specified altitude. This filter shall be sensor oriented.

(f) Display Number. A capability to enter up o 5 display numbers shall be provided. This function shall inhibit the recording of any data output to the specified displays.

Filters designated sensor oriented shall be applicable separately and independently to each sensor. They shall also be automatically initiated, per local adaptation, upon startup and dynamically alterable on line.

3.6.1.1.11.4.1 Data Type Control - Keyboard input message, shall be provided as follows:

(a) A keyboard message to initiate extraction. This message shall cause the extraction of the preselected set of data types (Section 3.6.1.1.11.1).

(b) A keyboard message to inhibit extraction. This message shall terminate the extraction of all data types.

(c) A set of keyboard messages to initiate the extraction of each of the data types listed in 3.6.1.1.11.1 except for sector time. Sector time shall always be extracted when any other data type is being extracted.

(d) A set of keyboard messages to inhibit the extractor of each of the data types listed in 3.6.1.1.11.1 except for sector time.

3.6.1.1.11.4.2 Recording Media Control - A keyboard input message shall be provided that shall allow operator control over the recording media and the unit (disc drive cf tape transport) to be used by the CDR function. If no input message is made the extractor shall utilize the preselected recording device.

3.6.1.1.11.4.3 Data and Time Control - Upon automatic initiation at startup, the CDR program shall make reference to and record the computer system time until it is updated to chronological time by the operator. At this point, the CDR program shall record that time sequence in hours, minutes and milliseconds. A keyboard message shall be used to enter the date; including two digits of the day, two digits of the month and two digits of the year. The CDR program shall immediately commence updating the entered date value on a daily and monthly basis until the program is manually or otherwise terminated.

3.6.1.1.12 Timeout Processing - System Timeout Processing consists of unrelated time tasks which must be periodically executed under executive control. These tasks include:

(a) Timeout I/O activity on all of the DEDS channels

(b) Timeout the receipt of beacon target inputs from the BDAS

(c) Update the clock time display on each display console

(d) Monitor controlled track files set up for a one-second delayed terminate

(e) Perform the three (system parameter) scan countdown on all accepted handoffs

(f) Monitor flight plans

(g) Timeout the data transfers to and from the RDAS

(h) Perform the three (system parameter) scan countdown on all identified (multifunction, BCN) uncontrolled track readouts

(i) Monitor the EM/RF/HJ/SA presentation in the system data area

(j) CTS capacity test

(k) Automatic track drop/handoff

(l) Timeout radar input processing

(m) Check RDAS alignment

(n) Re-enable reply processing following suspension due to malfunction

3.6.1.1.13 Thread Update Task - The operational program shall perform its track file (controlled, uncontrolled and unused) processing through the use of various threads in Central Track Store (CTS) and Track Number Pointer table. The simultaneous execution of tasks that use these threads shall not result in the altering of a thread by one task while another task is using that thread.

All thread modifications shall be performed in a unique task. This routine shall check to see if any thread changes have been requested. When a thread change request is detected, this routine shall then determine

which of the threads tc update and then update that thread(s).

3.6.1.1.14 Output Message Processing - This task supports other system tasks by transferring messages generated throughout the system to an output device. These messages are of three types:

(a) Recording (hardcopy) of significant system changes that result automatically or from keyboard inputs.

(b) Internal errcr or alarm messages.

(c) Configuration status request messages.

This task shall be as per NAS-MD-612 with the addition of:

1. Internal error or alarm messages for new subsystems (such as RDAS and disc) and functions.

2. System configuration messages that include equipment and software (3.6.1.1.11.4) configuration as well as display position configuration.

3. Output data shall be transmitted to one, two or all three of the console typewriters. On occassion, output data shall be transmitted to the MSP.

4. Output data tc the console typewriters shall be transmitted via the ICM data processing function.

3.6.1.1.15 Critical Data Recording - As part of the system recovery sequence (see Section 3.4.5.1.4), a capability shall exist to restore the system to the air traffic and control situation which existed at the time the system entered the recovery mode.

When the system is restored by a restart using critical data, all FDBs shall be forced into the coast list, no

timed out. FDBs in handoff status will be handled in the following manner:

(a) Clear all bits indicating that the FDB is in handoff status.

(b) If the ARTCC transmits a Track Update (TU) message for any flight plan with interfacility eligibility, reset the bits indicating that an Initiate Transfer (IT) message has been received and use the X, Y coordinates from the TU to position the FDB.

(c) When the ARTCC has accepted the handoff and the FB isin countdown to be dropped when the fault occurred, auto-acquire from the coast list and reinitialize the countdown.

Critical operational data shall be extracted continuously during system operation and stored on a disc subsystem to effect such restoration. The data shall include, but not be limited to system configuration, systems data including time, selected beacon codes, and track data and software initialization parameters.

3.6.1.1.16 Enhanced Target Generator - A capability shall exist to simulate the activities of a number of aircraft. The target generator shall accept commands from display keyboards or from a scenario magnetic tape (prepared off-line) t simulate the flight paths of up to 64 independent aircraft. The target generator shall accept parameter inputs from the display keyboard, and the scenario magnetic tape to control the mode of operation as well as the characteristics of targets. Commands shall control the following target characteristics.

(a) Beacon code and validity

(b) Altitude and validity

(c) Rate of ascent/descent

(d) Range

(e) Heading

(f) Rate of Change of Heading

(g) Speed

(h) Acceleration/Deceleration

(i) Spcial Position Indicator (SPI)

(j) Weak/Strong Target

(k) Radar and/or Beacon Targets

(l) Radar Report Run Length

The target generator shall have the following general functional capabilities:

(a) Combine live and simulated data.

(b) Add noise in target position.

(c) Duplicate targets.

(d) Ring targets.

(e) Control of Blip/Scan ratio and beacon fade.

(f) Identificatiocn of targets on display.

(g) Scenario control of targets from magnetic tape (prepared off-line).

(h) Selected displays isolated for target generator operation only.

3.6.1.1.17 Interfacility Communication Multiplexor (ICM) Data Processing - A capability to process output data to and input data from peripheral devices through an ICM shall be provided. This function shall receive data from appropriate tasks within the operational program. It shall store data, reformat data, and add device identifies information as necessary and output the data to the selected peripheral devices. The

function shall receive, store, and reformat, as necessary, data from the peripheral devices. It shall add device identifier information and shall indicate which task program shall receive the data for further processing.

The ICM data processing function shall monitor the ICM for proper operation and if a failure is detected it shall ensure that the failure recovery and reconfiguration sequence defined in 3.4.5.7.1 is accomplished.

3.6.1.1.18 Ancillary Software - The contractor shall furnish software capable of performing system support functions of an indirect operational nature. For example, to satisfy the requirement to rerecord on magnetic tape system data already stored on disc to provide the ability to promptly investigate an air traffic incident either on site or at another computer location. As a minimum a capability to perform the tasks listed and in the mode specified in Section 3.4.2 shall be provided.

3.6.1.1.19 Minimum Safe Altitude Warning (MSAW) - The contractor shall furnish within the operational program MSAW software as functionally specified in PX-11325, and any revisions thereto and as functionally updated in mutually agreed upon FAA operational software. The MSAW aural alarm shall operate in the multiprocessing system under normal operational conditions as well as first level backup.

3.6.1.1.20 System Data Base - The data base shall be based on the data base required for the ARTS III Beacon Tracking Level program but shall be enhanced to satisfy the functions specified herein. Part of the data base shall be site adaptation data to define such site variable items such as number of displays. It shall consist of, but not be limited to, the following items:

(a) Radar/Beacon Target Store

(b) Beacon Report Store

(c) Radar Report Store

(d) Central Track Store

(e) Track Present Map

(f) Radar Detection Map

(g) Console Typewriter Print Request Tables

(h) Display/Keyboard Parameter Tables

(i) Configuration Tables

(j) Common Active Track Buffer

(k) Selected Code Table

(l) Tabular Track Index

(m) Track Number Pointer Table

(n) Temporary Flight Plan Store

(o) VFR/IFR Code Table

(p) Time, Altimeter Setting and ATIS/GSI

(q) Emergency/Radio Failure/ Hijack/Suspect Aircraft

(r) Memory Readout

(s) MSAW Geography

3.6.1.2 First Backup Operational Program - The First Backup Operational Program shall be loaded into main memory and assume control of the system whenever the available equipment configuration allows if the available equipment cannot support the Full Capability Program. Normal configuration for the First Backup is 1 IOP and 1 MM less than full capability.

Use of this program will be independent of the particular IOPs and MMs available for program execution. This program shall be composed of the same capabilities as the Full Capability Operational Program

(see Section 3.6.1.1) except for the elimination of the radar related functions for one sensor, all on-call programs (e.g., ETG, utility), magnetic tape flight plan processing, and the automatic initiation of those tracks without discrete beacon identity codes. In addition, restrict the number of controlled tracks to 130 actively tracked tracks. The total number of tracks (including tabular tracks) does not change. Thus Radar Input Processing (see Section 3.6.1.1.3), and Radar/Beacon Correlation (Section 3.6.1.1.4) shall not be part of the First Backup Operational Program for one sensor and radar tracking in the Radar/Beacon Tracking (Section 3.6.1.1.5) task shall not be used for one sensor. The on-call programs and the automatic initiation function for the remaining beacon portion of the eliminated sensor will not be part of the first level backup program. The sensor to be excluded shall be determined by the site adaptation data base.

3.6.1.3 Second Backup Operational Program - The Second Backup Operational Program shall be an emergency backup to be used only in unusual circumstances. This program shall be a subset of the First Backup Program. Functions shall be deleted to allow some air traffic control capability in the minimum configuration possible. The following functional items may be deleted from the list in Section 3.6.1.1 (in order of increasing priority): b, c, the radar portion of d, o, g, i, n, j, p, q, and r. Reduced display or track capacity may be allowed if required. The contractor shall submit a proposed functional definition for this emergency backup program for government review following a sizing analysis. Use of this program shall be independent of the particular IOPs and MMs available for program execution, except for the case of units removed from the system because a specific two IOPs have been removed.

3.6.2 Support Software - ARTS III support software shall be modified and expanded consistent with the NY TRACON system environment. Support software shall provide for semi-automated support functions just as the operational software provides for semi-automated operational functions.

3.6.2.1 Assembler - An assembler shall be provided for the system described herein. The assembler shall provide all the capabilities of the existing ARTS III Assembler, as described in PX-6196, and meet the requirements prescribed herein. The assembler shall also be capable of assembly of operational BTL software programs as well as the largest program requirements of itself and RT&BTL systems. The assembler shall be an integral part of the support software system and shall operate on a minimal data processing subsystem. The assembler shall require 32K memory, one disc drive, one Console Typewriter, one magnetic tape unit, and one medium speed printer.

3.6.2.2 Builder - The builder shall provide the capability of loading and linking all the executive modules, tasks and data bases that make up an operational program for the New York TRACON and for RT&BTL systems. The builder shall be physically segmented into two sections. The first section shall be generated in bootstrap format, and shall include a relative loader, a control routine, an I/O handler for the magnetic tape unit, the console typewriter, the disc subsystem, and the medium speed printer. The second section shall be generated in relocatable format acceptable for loading by the relative loader. The builder shall be executed in a one IOP configuration. The builder shall require not more than two memory modules and/or one disc for instructions, data, and buffers.

3.6.2.3 Builder Utility Program (BUP) - The Builder Utility Program (BUP) shall provide a convenient, efficient means of building, modifying, and inspecting an organized set of programs for the New York TRACON and RT&BTL systems. BUP shall be used to build system recovery libraries as defined below. BUP shall be a non-resident subset of the builder that shall be loaded only when specifically commanded by an operator. BUP shall be interactive with an operator in direct control throughout all BUP operations. BUP operation shall be terminated by transferring control back to the builder control routine. All BUP operations shall be controlled from a console typewriter.

BUP shall be executed in a one IOP configuration. BUP shall require not more than two memory modules and/or one disc for instructions, data, and buffers.

An optional capability shall be provided to bootstrap load the absolute formatted portions of the builder from a Disc or magnetic tape unit. BUP shall utilize these portions of the builder for loading, for communications with the console typewriter, and for the builder utility functions (e.g., inspect, change, dump, store constant, and assign features).

BUP shall provide the capability to operate without a Disc and thereby generate recovery system libraries (RSLs) entirely on the Magnetic Tape Subsystem.

3.6.2.3.1 Recovery System Library - An organized set of programs and the recovery module shall be called a Recovery System Library (RSL). A recovery system library shall consist of physical records. The first record shall always be the recovery module. A directory of system programs shall always be the second record. A directory of diagnostic programs shall always be the third record. System programs and diagnostic/utility programs shall start with the fourth record.

3.6.2.4 Continuous Data Recording (CDR) Editor - The editor program shall provide a formatted printed output of data written by the CDR extractor.

3.6.2.4.1 Equipment Configuration - The editor shall require DPS resources of no more than one IOP and one MM. It shall have the capability of being loaded into the DPS from either the DISC subsystem or the magnetic tape unit. It shall be capable of processing extracted data from either disc or magnetic tape and outputting printed data on the MSP. Control of the editor operation shall be from the console typewriter.

3.6.2.4.2 Data Types - The editor shall be capable of selectively printing the following extracted data types:

(a) Radar Reply Data

(b) Radar Target Reports

(c) Beacon Reply Data

(d) Beacon Target Reports

(e) Correlated Radar and Beacon Target Reports

(f) Tracking Data

(g) Automatic Functions

(h) Manually Entered Functions (keyboard)

(i) Display Data

(j) Interfacility (input and output) Data

(k) Remote Tower Data

(l) Error and Status Message Data

(m) System Utilization Data

(n) Flight Plan Data

(o) Sector Time

(p) Minimum Safe Altitude Warning (MSAW) Alarm data

Nothing in the design shall preclude the later inclusion of other types of data, e.g., metering and spacing and conflict prediction data.

3.6.2.4.3 Filters - A filter is a parameter or range of values for which the data editing shall be in effect. This shall enable the operator to examine specific data without having to printout all extracted data. The following filters shall be provided:

(a) Time (Start and End): This filter when activated shall enable an editor printout of all data types or selected data types that have been recorded between the designated

time limits.

(b) Sensor Selection: This filter when activated shall enable an editor printout of all relevant data types or selected data types for the designated sensor(s). A capability to designate any number of up to four sensors shall be provided.

(c) Area Filter: This filter when activated shall enable the printout of all relevant data types or selected data types that lie within a designated area. The area shall be defined by three range values, expressed in nautical miles by two decimal digits, and three azimuth values, expressed in degrees by three decimal digits, as implemented by the ARTS III auto-drop logic. A capability to define an area filter for each of four sensors shall be provided.

(d) Altitude Filter: This filter when activated shall enable the printout of all relevant MODE C data types or selected MODE C data types that lie within the designated altitude limits. A capability to designate a pair of altitude limits for each of four sensor(s) shall be provided.

(e) Beacon Code Filter: This filter when activated shall printout the target reports and track data for the designated beacon codes. Both discrete and non-discrete codes may be designated. A capability to select up to five beacon code blocks (non-discrete) and/or five discrete beacon codes shall be provided for each selected sensor.

(f) Aircraft ID Filter: This filter when activated shall printout all track data for the designated aircraft. A capability to designate up to five separate aircraft IDs shall be provided.

(g) Display Filter: This filter when activated

shall printout display data for the designated display. Both a DEDS and an RTDS may be designated. A capability to select up to five displays shall be provided.

3.6.2.4.4 Beacon Data Reduction - A beacon data reduction capability shall be provided with the editor. This capability shall include the following:

(a) A printout of all duplicate beacon reports for any scan in which a duplicate report is found.

(b) A printout of all duplicate beacon reports of any selected code block for any scan in which a duplicate is found.

(c) A printout of all duplicate beacon reports of any selected discrete code for any scan in which a duplicate is found.

(d) A summary printout each scan that contains the total number of targets, the total number of Mode 3/A targets, and the total number of Mode C targets.

3.6.2.4.5 Editor Control - A message input capability from the console typewriter shall be provided for operator control of the editor. This capability shall include but not be limited to:

(a) A selection of any combination of the data types listed in section 3.6.2.4.2.

(b) A selection of any combination of the filters listed in section 3.6.2.4.3. Where applicable, it shall also be possible to select the data types that shall be affected by the filter.

(c) A selection of any combination of the beacon data reduction categories listed in section 3.6.2.4.4.

(d) A command to stop all printing at the next

scan. This command shall reinitialize the program to wait for further operator commands.

Wherever possible selection shall be single key action. It shall be possible tc designate several selections within a single input message.

3.6.2.4.6 Output - Labels (column headings) shall be provided for each data type and category of data within a data type. These labels or column headings shall be printed on each page.

Azimuth data shall be printed in ACPs and degrees.

Sector time shall be printed in hours, minutes, seconds and milliseconds.

Sector time shall only be printed when there is other data being printed.

3.6.2.5 Diagnostic Software

3.6.2.5.1 Systems Diagnostics - A system diagnostic/mcnitor test shall be supplied. The purpose of the system diagnostic/monitor shall be to (a) ascertain the operability of equipment functions associated with the systems and (b) provide a maintenance tool which has the capability of exercising the system to nearly the same degree as the operational program and to isolate problems which may occur under this level of exercise.

The system diagnostic shall be modular in nature. That is any combination of subprograms can be added to achieve the degree of system verification desired. As a minimum the system diagnostic program shall be comprised of the following test subprograms:

(a) Diagnostic Mcnitor Subprogram

(b) Processor Subprogram

(c) Memory Unit Subprogram (including Central Memory Access Unit)

(d) Data Entry and Display Subprogram (including MDBM)

(e) Beacon Data Acquisition Subsystem Subprogram

(f) Remote Tower Display and Data Entry Subprogram

(g) Interfacility Communications Multiplexor Subprogram

(h) Mass Storage Subsystem Subprogram

(i) Radar Data Acquisition Subsystem Subprogram

3.6.2.5.2 Subsystem Diagnostics - The contractor shall supply a separate set of equipment-oriented diagnostic programs which operate "off-line". These diagnostic program shall include the features necessary to meet the equipment maintainability requirements specified in Section 3.8. As a minimum, diagnostics shall be provided for each of the following system equipment items.

(a) IOP

(b) Memory Module

(c) Interfacility Communications Multiplexor

(d) Disc Subsystem

(e) Beacon Data Acquisition Subsystem

(f) Radar Data Acquisition Subsystem

(g) Data Entry and Display Subsystem

(h) MSP

(i) Central Memory Access

(j) MDBM

(k) Remote Tower Display and Data Entry Subsystem

(l) Console Typewriter

(m) Magnetic Tape Unit

The diagnostics shall provide the complete capability of testing, monitoring, and evaluating all logical/programmable functions within the module under test. The diagnostics shall detect 95 percent of all failures and provide isolation of 75 percent of those single, non-intermittent Printed Circuit Board (PCB) malfunctions to an average of three printed circuit cards of any type. (This assumes a PCB size of 3 inches by 4 inches. For larger PCBs, isolation shall be to a single PCB.) In equipments where cards are not employed, malfunctions shall be isolated to a group of replaceable circuit elements equivalent to the logic contained on three average printed circuit cards. This isolation shall be accomplished using a combination of automatic and manual procedures.

A capability for manual call up of diagnostics shall be provided to be used in an off-line mode. This means that no operations shall occur in the module under test at the time the module diagnostic is being executed. Each program shall assume that all modules necessary for test use, except the module under test, are in proper operating order. All execution of these diagnostics shall be from the appropriate IOP's indicator panel. The manual call diagnostics shall be manually loaded from magnetic tapes.

3.6.2.6 Debug Aids - The debug aids are programs which may be used in the program development and program maintenance efforts to assist in the isolation of program related problems. The debug module is a removeable part of the executive program. The other debug aids described below are self contained programs which may be loaded with the operational program.

3.6.2.6.1 Debug Module - The debug module shall be a removeable segment of the executive program intended for use at a support facility. The debug module provides the programmer with the tools for the integration and checkout of a program task. The debug module shall provide the following functions:

(a) Software Breakpoint - This function shall enable or disable a breakpoint operation. When a processor reaches a software breakpoint, the processor shall be placed in a suspended state. It shall be possible to request any debug function following a breakpoint hit.

(b) Program Segment Timing - This function shall determine the elapsed time between the execution of two specified timing breakpoints and provide output timing statistics on the printer.

(c) Snap Dump - This function shall output immediately the contents of a limited area of memory whenever a processor reaches a specified memory address. Output shall be routed to printer, console typewriter or magnetic tape.

(d) Change Memory - This function shall change the content of a specified memory word to the data value specified by the user. The old and new data values shall be printed following the change.

(e) Dump Memory - This function shall search a specified area of memory for a selected bit configuration and print the address of each find.

(f) Suspend Processor - This function shall cause the requested processor(s) to enter a suspended state with task processing discontinued. A suspended processor shall remain available for processing of other debug requests. A suspended processor shall resume processing upon command.

(g) Register Dump - This function shall output the content of pertinent registers at a selected breakpoint.

(h) Processor History - This function shall

collect and print history data including executive service requests, interprocessor interrupt type executed, planned tasks executed, popup tasks executed, processor number, and realtime clock.

3.6.2.6.2 Miscellaneous Debug Aids - These debug aids shall be capable of being included in the operational tasks and the executive program. These debug aids shall be as follows:

(a) Print Memory - Print the contents of the memory area specified by a start and end address in the processor registers. Printout is on an MSP.

(b) Write Bootstrap Format - This program shall write the contents of the specified area of memory onto tape in bootstrap format.

(c) Console Typewriter Print - This program shall print the contents of the specified area of memory on the Console Typewriter.

(d) Search Core - This program shall search the contents of the specified area of memory for a particular masked value.

3.6.2.7 Enhanced Target Generator Scenario Tape Builder - An enhanced target generator scenario tape builder shall be provided. The off-line tape builder shall provide all of the functional capabilities of the existing ARTS III tape builder. The builder shall be capable of producing a magnetic tape which in conjunction with the ETG will display in a preplanned chronological sequence simulated radar and beacon targets. It shall also be capable of introducing at predetermined times flight plan data in a manual simulating the Interfacility and Bulk Store Flight Plan subprograms.

3.8 System Availability, Reliability and Maintainability - The contractor shall plan and implement a reliability and maintainability program in accordance with MIL-STD-785 and MIL-STD-470, except as

modified herein, to meet the requirements of this specification and to meet the detailed reliability, maintainability, and availability requirements specified herein. The System reliability shall be such that, in conjunction with achievement of the maintainability requirement, the system availability requirements shall be met. Hardware modules shall be designed, constructed and tested in accordance with FAA-E-2591a. The system shall be designed to be maintained with a minimum of external test equipment and use of standard hand tools. Corrective maintenance shall be effected by replacement of defective module(s) with subsequent repair of the defective module(s) off-line. Requirements for adjustments shall be kept to a minimum. The design, to the maximum extent possible, shall maximize interchangeability, minimize the need for adjustment and attempt to limit the variety of modules, and PC boards, used in the system.

3.8.1 Applicable Definitions - The reliability, availability and maintainability definitions used in this specification are those of MIL-STD-721, with the additions or modifications as noted below:

(a) Mean-Time-to-Repair (MTTR) - The mean-time-to-restore to an operational condition a function or equipment that has failed. The function or equipment may be restorable by corrective maintenance repair, substitution by module or PC board replacement.

(b) Availability - The probability of specified operability at any time over the service life of the system. Allowed preventative maintenance times need not be counted as unavailable periods or down-time, provided the requirement to reach an operable state as defined herein is always met. Availability is the quotient of the total system up-time divided by the sum of the total system up-time and down-time.

(c) Service Life - Intended useful life of system. Short life items are replaced on a

scheduled basis under the preventative maintenance plan. For the New York TRACON System, the service life is at least ten (10) years.

(d) Module - That component part, assembly or element as defined by the contractor and approved by the government and designated as the first level of maintenance required to repair or restore the system function to normal and provide the service intended.

3.8.2 System Failures - System failures fall into two categories, functional failures and equipment failures. Both categories can be chargeable as down-time in determination of system availability, system MTBF, or both.

3.8.2.1 Functional Failures - Functional failures are those failures which: (1) cause either the complete or partial loss of a functional capability required by this specification; (2) cause degraded operation of a function by deviating from the performance requirements of 3.10; or (3) cause the erratic, erroneous, transient or unintended operation of any function. A functional failure shall not be declared during a normal 10 second recovery operation.

3.8.2.2 Equipment Failures - Equipment failures are rack, drawer, module, card, or part failures whose impact upon the system functions may vary from a minor maintenance action to catastrophic. For example, the failure of a BDAS whose redundant unit takes over automatically, with no loss of a function, is only an equipment failure and does not impact on system availability. However, the random or catastrophic failure of a module that effects the data presented at one or more displays is both an equipment and functional failure, and therefore impacts on system availability.

3.8.3 Reliability and Maintainability (R&M) Program

3.8.3.1 Program Plan - The contractor shall prepare and submit for approval a R&M program plan in

accordance with MIL-STD-785 and MIL-STD-470. This program plan shall be submitted with the technical proposal and updated within sixty (60) days after award of contract. This program plan shall include software reliability.

The contractor shall define his reliability and maintainability goals and indicate how he intends to develop and implement a plan for identifying key "design to" characteristics in order to minimize maintenance, reduce technical skill requirements, establish the optimum frequency and extent of preventative maintenance, and improve maintenance methods and diagnostic routines.

3.8.3.2 R&M Management - The contractor shall have one clearly identified organizational element which shall be responsible for the planning and management of the R&M program specified herein and for insuring its effective execution. The individual designated as head of this management organization shall have the necessary authority and resources, and report at a level having full responsibility for the contract effort to enable him to implement and enforce the requirements specified herein.

3.8.3.3 Program Tasks - The R&M program shall include the elements of MIL-STD-785 with the following tasks modified as indicated in the paragraphs hereunder.

3.8.3.3.1 R&M Design Reviews - The program plan shall include design reviews of the system, its functions and equipment. They shall include a preliminary design review and a critical (predesign release to manufacturing) design review. Other reviews may be called as necessary either by the contractor or the Government. The Government shall participate in all reviews. These reviews shall be scheduled as part of the ARTS IIIA System design reviews. The contractor shall notify the Government of design reviews at least thirty (30) days prior to their occurrence and submit complete data packages at time of notification. Items to be covered as a minimum in the conceptual and critical reviews are the tasks that follow.

3.8.3.3.2 Availability Apportionment Task - The contractor shall apportion the availability requirements of each constituent component of the System. Constituent components shall be, as a minimum, considered to be modules encompassing singular functions or operations, i.e., IOP, power supply module, control unit, printed circuit board and software program. They shall be such that they will be in agreement with the reliability, and maintainability requirements specified herein. These apportionments shall be submitted in the technical proposal and shall be in the availability requirements of the contractor's design. Any changes shall be submitted to the Government for review and approval. Approval of these data does not release the contractor from the requirement of meeting the system availabilities and detailed R&M requirements specified herein.

3.8.3.3.3 R&M Modeling Task - The System shall be reliability and maintainability modeled. The contractor shall identify critical items or paths whose failure will either cause system or subsystem failures, major performance degradation, loss of a function, marginal operational conditions or departures from the R&M Requirements, as specified herein. From the R&M predictions and the R&M models, together with system operational loading, critical elements shall be highlighted with emphasis upon means of sustaining operation, via techniques such as redundancy, manual patches, and over-capacity, in the event of failure. Note, however, that the ability to sustain or reinstate operation in this manner shall not prevent the incident from being classified as a failure. Preliminary R&M estimates for each of the models shall be submitted with the proposal and shall be updated as necessary to reflect system changes as they may occur. A final version containing all system details shall be submitted and included as part of the critical design review data package, and shall be subject to the review cycle as specified. The R&M Modeling shall include the following two configurations:

(a) Radar Tracking and Beacon Tracking Level (RT&BTL) system with four radar and beacon sensor inputs.

(b) RT & BTL system with four beacon sensor inputs and three radar sensor inputs.

3.8.3.3.4 Failure Modes, Effects and Criticality Analysis (FMECA) Tasks - A FMECA shall be performed. This analysis shall be conducted down to the level of modular replacement in normal maintenance (e.g., printed circuit card, power supply module). For each such replaceable item, the dominant modes of failure shall be determined. Based upon these modes of failure, the effect on subsystem and system performance shall be ascertained. The analysis results shall be employed to evaluate and change the reliability maintainability-availability (RMA) model, if necessary. The task shall be completed and reviewed at the critical design review and used in preparation of the maintainability demonstration tasks. A preliminary analysis utilizing the reliability model shall also be submitted ninety (90) days after contract award and updated thereafter as design or system changes occur. The FMECA will be reviewed as part of each design review. Any further changes in the FMECA shall be submitted at least sixty (60) days prior to initiation of the reliability or maintainability demonstrations specified in Section 4.0.

3.8.3.3.5 Parts Control Task - The contractor shall establish a parts control effort that shall, to the maximum extent possible: (a) assure the utilization of standard parts or assure proper useage application of all commercially available off-the-shelf equipment permitted by FAA-E-2591a; (b) assure the suitability of nonstandard parts that are subject to Government approval prior to being incorporated in the system design.

3.8.3.3.6 Failure Reporting, Analysis and Corrective Action Task - The contractor shall establish a closed loop system for reporting all failures. The level of equipment (e.g., circuit board or module) both manufactured and subcontracted items, for which the contractor proposes to maintain failure records shall be included in the technical proposal. As a minimum, failures occurring from the time of final manufacturing unit testing forward to the end of the warranty period

shall be reported with analysis and results. The contractor shall analyze each failure to determine its cause. Analysis and results of failures will not be required on commercially available off-the-shelf equipment. Each analysis shall include development of corrective action to prevent reoccurrence. Failure reports shall be maintained by the contractor to which the Government will have unlimited access. A copy of any individual report shall be provided to the Government on request. Subcontracted item failures shall be handled on an as-required basis. Whenever a significant problem becomes evident, the analysis and corrective action of that problem shall be made.

3.8.3.3.7 Reliability and Maintainability Demonstration - Demonstration of achievement of RMA requirements shall be accomplished by means of R&M demonstration tests as described in Section 4. A summary report of failures shall be submitted so that trends and patterns, can be discerned. The failure summary shall also include the relevancy of the reported failures. Sufficient data shall be included in the summaries to verify the relevant/non-relevant classifications.

3.8.4 R&M Design Parameters

3.8.4.1 System Recovery After a Power Failure - In the event of a power failure or out-of-tolerance transients of line voltage, the system shall be designed to protect itself from damage and shall prevent loss or alteration of system stored data. When normal power levels have returned, previously stored data shall be displayed, and all functions shall automatically, without operator action or intervention, be made available to the controller within 10 seconds after resumption of power and the disc drives are up to speed. Power failures shall not result in the loss of any data stored in memory prior to a power failure.

3.8.4.2 AC Power Transients - The following AC power transient conditions shall not be considered a power failure and the equipment shall continue in normal operation; using nominal AC input power of 120 VAC at 60 Hz.

(a) Transients that cause the line voltage to decrease to less than 90 percent of nominal when:

1. The transient is 8 milliseconds or less in duration and the line voltage is 95 to 110% of nominal immediately prior to the transient, or

2. The transient is 4 milliseconds or less in duration and the line voltage is 90 to 95 percent of nominal immediately prior to the transient.

(b) Transients that cause the line voltage to increase to more than 110 percent cf nominal but less than 130 percent when the transient is 17 milliseconds or less in duration.

(c) Transients that cause the line voltage to vary by plus or minus 10 percent from nominal for any duration of time.

(All reference to line voltage is line to neutral)

An interruption (AC voltage has gone outside the range of 90 to 110 percent of nominal) may start at any time during a 60-cycle period with the requirements above still applicable.

3.8.4.3 System Maintainability - Design of the hardware and software shall provide a system capable of having faults isolated to the correct unit in an average time of not more than 5 minutes. The contractor shall discuss in the proposal the maintenance concept, tailored to MIL-STD-470, and include the following system maintenance parameters:

(a) Cost tradeoffs and reliability considerations involved in the application of both preventive and corrective maintenance.

(b) Number and skill level of maintenance personnel and type of specialized training

required to maintain the system.

(c) Level of the diagnostic support.

(d) Type of printed circuit board malfunction isolation and repair technique.

(e) On-line system performance monitoring.

3.8.4.4 Maintenance Concept - The maintenance concept shall be to localize a failure through use of system monitoring features, and software and hardware maintenance features and to replace the failed module elements or pluggable unit from site spares. The actual repair of the defective or failed item shall be accomplished off-line at the convenience of maintenance personnel.

3.8.4.5 Equipment Isolation - Design shall be such that component failure within any equipment module shall not cause failure in another module.

3.8.5 System Reliability Parameters - The System shall meet the reliability, maintainability and availability (RMA) specified herein when operated in the environment required of hardware modules as specified in FAA-E-2591a. The system requirements must be met at all combinations of the specified service conditions, however it shall be demonstrated when operating in the environment specified in FAA-E-2591a.

3.8.5.1 System Availability - The availability of the full system shall not be less than 0.9975 with a Mean-Up-TIME (MUT) of at least 200 hours. The system is considered available if not more than 4 simultaneous DEDS failures have occurred. The Continuous Data Recording Function is not required.

3.8.5.2 Corrective Maintenance - Equipment failures shall have a Mean-Time-to-Repair (MTTR) of thirty (30) minutes or less with a maximum time not exceeding one (1) hour.

3.8.5.3 Reliability - Reliability shall be in accordance with FAA-E-2591a.

3.8.5.4 Maintainability - Maintainability shall be in accordance with FAA-E-2591a.

3.8.5.5 Preventive Maintenance Plan - The contractor shall develop a preventive maintenance plan, including all preventive maintenance tasks and the frequency at which they will be performed. These tasks shall be incorporated as a part of the Maintenance Instruction Manuals.

3.9 Test Equipment

3.9.1 Special Tools and Test Equipment - The terms special tools and test equipment are defined as those tools and test equipment not carried as a standard line by the contractor or another manufacturer. All special tools and test equipment necessary for the installation, repair, adjustment, test and maintenance of the system specified herein, not readily available on the open market, such as alignment wrenches, testing devices, jigs, special purpose test cables, and circuit card extenders, shall be supplied with the equipment. The contractor shall submit for Government review a complete list of special tools and test equipment, the application of each, and unit and/or component for which it is required. This shall be submitted prior to fabrication or procurement of any specialized tools and test equipment for use at Government facilities. The design of the equipment shall be such as to permit the use of standard tools and test equipment in so far as practicable.

3.9.2 Standard Test Equipment - The contractor shall provide a list of standard test equipment which will be required as a minimum to maintain the system. The information in this list shall include but not be limited to the following for each item of test equipment:

(a) Intended use, for example, measure voltage, or count pulses.

(b) Ranges required.

(c) Accuracy requirements.

(d) Special parameters, for example, short term drift, long term stability, and temperature requirements.

(e) At least three suggested sources of supply.

(f) Estimated cost (catalog prices) for single units and quantities.

(g) Estimated frequency of use.

3.10 System Performance Requirements - The system shall meet all the performance requirements in this section simultaneously when performing the operational functions required by this specification. These performance requirements shall be satisfied when operating under the traffic loads and environmental conditions specified in the contract. Adherence to the performance requirements shall be measured in the tests described in section 4. Performance requirements are defined for the following functional areas:

(1) Target detection/declaration

(2) Tracking

(3) System throughput/response

(4) Continuous data recording

(5) Display data

(6) Failure recovery/system reconfiguration

(7) System Capacity

3.10.1 Radar Target Detection - The target detection function shall meet, and be tested to, the following performance criteria.

3.10.1.1 Final Detection Performance - The detection window used in the final detection process shall sample the returns received at the same 1/16 N.M. range cell for as many sweeps as contained in the beamwidth of the antenna pattern of each radar. The sample size

(sweep/beamwidth) shall be a parameter between 8 and 48 and be set for each site. The false alarms generated by radar noise input tc the window (no clutter, no targets) shall ccnform (plus or minus 10%) to equation:

$$P_{FA} = P_N(1 - P_N) \left[\frac{(N - 1)!}{(T_L - 1)!(N - T_L)!} \right] P_N^{(T_L - 1)} (1 - P_N)^{(N - T_L)}$$

Where N = sample size (sweeps per beamwidth)

P_N = probability of noise pulse in any range quantum (as defined in FAA-E-2591a, Paragraph 3.1.17.2.4, Log Normal Rank Order Quantizer)

T_L = target leading edge threshold, which shall be a site adaptable parameter between 4 and 24

P_{FA} = probability of a false alarm.

3.10.1.2 Center Azimuth Estimation - Target center azimuth estimation shall have a standard deviation cf no greater than 0.2 degrees for a target that is 6 db stronger than noise.

3.10.2 Tracking - The performance of the tracking module shall be defined and measured within two areas:

(a) tracking capability

(b) track quality

3.10.2.1 Tracking Capability - The tracking module shall track all types cf aircraft under varying conditions of traffic density and environment. In this context, "type" refers to aircraft with discrete-coded beacon transponders, non-discrete coded transponders, and no transponders. Tracking shall be maintained during periods of missing returns, the duration of the

period being controlled by a variable site parameter.

Finally, for dual radar/beacon systems, when one sensor fails, tracking shall be maintained in the area overlapped by both sensors.

3.10.2.2 Track Quality - Track quality is expressed in terms of track reliability and track accuracy.

3.10.2.2.1 Track Reliability - Track reliability is a measurement of the ability of the tracking system to follow an aircraft under various conditions of aircraft maneuver and environment, and maintain its identity. There are a number of measures of track reliability:

(a) Track Correlation Ratio: The ratio of the number of track-scans in which all tracks correlated tc the total number of track-scans in which those tracks were beig tracked. The Track Correlation Ratio requirements shall be as follows:

Discrete Beacon Aircraft: Greater than or equal to 95% for both straight and level flight and maneuvers for all speeds when the discrete blip/scan ratio is greater than or equal to 95%.

Non-Discrete Beacon and no Beacon Aircraft: $\leq$90% for both straight and level flight and maneuvers when the discrete blip/scan ratio is $\geq$95%.

(b) Track Loss Probability: The Track Loss Probability is the probability that a track will be completely dissociated with the data (tabular coast list) for one cr more scans. When the individual beacon and search blip/scans are greater than or equal 95% and the range and azimuth standard deviations are .04 nm and 0.23 degrees respectively, the track loss probability shall be as follows for all speeds less than or equal to 400 knots.

Discrete Beacon Aircraft: No track loss for both straight and level flight and non-military maneuvers.

Non-Discrete Beacon and No-Beacon Aircraft in the clear: Less than or equal o 1% for straight and level flight; less than or equal to 5% for non-military maneuvers.

(c) Track Swaps: The track swap requirements shall apply to a variety of maneuvers of two or more aircraft including shallow (less than or equal to 10 degrees) cross-over and overtake patterns. Track swaps shall include erroneous identity in the data block as well as track loss under a swap opportunity. The requirements shall be as follows:

Discrete Beacon Aircraft (at least one of the pair): No track swaps.

Non-Discrete Beacon and No-Beacon Aircraft (both aircraft): Less than or equal to 5% of the total of all swap opportunities.

3.10.2.2.2 Track Accuracy - The output of the tracking module shall meet the following accuracy requirements:

(a) Straight and level flight: For straight and level flight, track accuracy is expressed in terms of the standard deviation (sigma) of the error between the true value, and the calculated value. For the standard deviations given below, the aircraft slant range is between 15 and 50 nautical miles and the aircraft speed is 150 knots.

Position Error: Less than or equal to 300 feet.

Speed Error: Less than or equal to 12 knots.

Heading Error: Less than or equal to 5 degrees.

(b) Maneuvers (Dogleg): For maneuvering aircraft in a standard rate turn (3 degrees/sec if speed less than 200 knots, 1 1/2 degrees/sec if speed is greater than or equal to 200 knots), track accuracy is expressed in terms of the expected value of the error between the estimated value and the true value. For maneuvers, the significant parameters are RMS errors and the time it takes for the RMS error to be reduced to the straight line error when the aircraft returns to straight line flight. For the values given below, the aircraft slant range is between 15 and 50 nautical miles, the aircraft speed is 150 knots, and the dogleg angle is 90 degrees. The requirements shall be:

	Return to Straight Line Performance
RMS Position Error: 600 feet	10 scans
RMS Speed Error: 55 knots	10 scans
RMS Heading Error: 21 degrees	8 scans

These values apply to beacon equipped aircraft and non-beacon aircraft in the clear. The target report quality shall be as specified under "Track Loss Probability" in Section 3.10.2.2.1.

3.10.3 System Throughput/Response

3.10.3.1 Response to Video Signals - The time to display symbology after a video signal is received from the radar or beacon set shall be no greater than 1.2 seconds for controlled tracks and 2 seconds for uncontrolled tracks.

3.10.3.2 Response to Controlled Aircraft Actions - The time to process the keyboard entry, complete the entry requirements and display the appropriate alphanumerics shall be no greater than 1.2 seconds after the

completion of the keyboard entry.

3.10.3.3 Preview Character Display - The time to display a character in the preview area shall be no greater than 0.2 seconds after the character entry.

3.10.3.4 Response to Data Readout Requests - The time to display the requested data shall be no greater than 0.5 seconds after the keyboard entry.

3.10.3.5 Data List Relocation - The time to complete the task shall be no greater than 1.2 seconds after the keyboard entry.

3.10.3.6 Response to Uncontrolled Aircraft Action - The time to process the keyboard entry, complete the entry requirements and display the appropriate alphanumerics shall be no greater than 1.2 seconds after the completion of the keyboard entry.

3.10.3.7 Response to Quick Look Actions - The response time for a quick look request shall be no greater than 1.2 seconds.

3.10.3.8 Response to Automatic Offset - The response time for an automatic data block offset shall be no greater than 1 scan time after the data block conflict occurs.

3.10.3.9 Response to Trackball - The response time for trackball position symbol movement shall be no greater than 0.25 seconds after the trackball has been moved.

3.10.3.10 RTDS Throughput - The time to display an alphanumeric data tag or symbol after the associated video signal is displayed shall be no greater than 2.5 seconds for the Remote Tower Display Subsystem.

3.10.4 System Capacity - The system shall be capable of achieving the performance requirements of this specification when processing the system load specified below:

1. Number of radar targets, each sensor: 300/scan

2. Number of radar targets in one sector (11.25 degrees), each sensor: 25

3. Number of false radar targets each sensor in addition to the number of radar targets of item 1: 50/scan

4. Number of beacon targets (all Mode C) each sensor: 130/scan

5. Number of beacon targets in one sector (11.25 degrees), each sensor: 15

6. Fruit rate (undefruited input) each sensor: 2000/sec

7. Full Data Block each display: 20 (14 character tag)

8. Full Data Blocks, each tower display: 10 (14 character tag)

9. Limited Data Blocks, each display: 15 (3 character tag)

10. Limited Data Blocks, each tower display: 10 (3 character tag)

11. Tacbular Messages, each display: 15 (10 characters)

12. Tabular Messages, each tower display: 15 (10 characters)

13. Controlled Single Symbols, each display: 100

14. Controlled Single Symbols, each tower display: 50

15. Uncontrolled Single Symbols, each display: 100

16. Uncontrolled Single Symbols, each tower display: 50

17. Displays, 44 TRACON, 7 RTDS

18. Keyboards, 84 TRACON, 7 RTDS

19. The ratio of controlled to uncontrolled aircraft is 2:1

The above data shall be used as a guide for the design of the software architecture.

Table 3.10-1 shows the sensor/display configuration for the 30 operational TRACON displays.

3.10.5 Display Data - The System shall have the capability of presenting simultaneously on each DEDS the display load shown in TABLE 3.10-2. Under these load conditions the Display Buffer Memory shall meet a data output rate to the DEDS such that the refresh rate shall be 24 Hz or higher.

3.10.6 Automatic Failure Recovery/System Reconfiguration - Automatic failure recovery shall occur in the following situations:

1. Failure within the data processing subsystem (see section 3.4)

2. Failure of one unit of a redundant pair; i.e., BDAS

3. Failure in one channel of a unit with dual channel interconnection to the data processing subsystem.

3.10.6.1 Data Processing Subsystem Failure Recovery - Recovery from a power failure shall use the same NDRO/Recovery Module logic as other failurs which trigger the scatter interrupt. Whenever power on a processor drops below a given level, the processor issues a scatter interrupt and reverts to a Master Clear state. If this processor was the only one that suffered a power loss, the system shall recover without including it in the system resources. If the power failure affected all processors, they would all reach the Master Clear state and remain there until power

TABLE 3.10-1

SENSOR/DISPLAY CONFIGURATION

Prime Sensor	Alternate Sensor	Number of Displays
JFK	EWR	11
EWR	JFK	8
EWR	HPN	1
HPN	JFK	2
HPN	EWR	2
HPN	ISP	2
ISP	JFK	3
ISP	HPN	1

TABLE 3.10-2

DATA DISPLAY MODEL

DATA	DISPLAY TYPE 1, II
FULL DATA BLOCK	24
LIMITED DATA BLOCKS	100
SINGLE SYMBOLS	50
TABULAR LINES	15

FULL DATA BLOCK	CONSISTS OF TARGET SYMBOL, LEADER, AND 14 CHARACTER TAG
LIMITED DATA BLOCK	CONSISTS OF TARGET SYMBOL, LEADER, AND 3 CHARACTER TAG
SINGLE SYMBOL	CONSISTS OF TARGET SYMBOLOGY
TABULAR LINE	POSITION ADDRESS AND 10 CHARACTERS

exceeded a given threshold. When a processor exceeds this threshold, it again generates a scatter interrupt and the recovery process begins. Not all processors will have power restored simultaneously and hence, a series of scatter interrupts shall be generated. When the last of the series of scatters has beengenerated, the recovery logic commences in a normal fashion. The NDRO program does the preliminary processor and memory resource evaluation. The disc subsystem shall require a certain amount of time for the drives to reach normal speed and position the read/write heads. After the disc is operable, the recovery module is loaded and the recovery process described in section 3.4.5 continues. Automatic recovery and reconfiguration from a DPS failure shall not exceed 10 seconds when using the disc subsystem and the disc drives are up to speed.

3.10.6.2 Redundant Unit Recovery - When one unit of a redundant pair has failed, (e.g., the BDAS) recovery and reconfiguration to the alternate unit shall require no more than 250 milliseconds.

3.10.6.3 Dual Channel Recovery - When failure has occurred in one channel of a unit with a dual channel interconnection to the data processing subsystem, recovery and reconfiguration to the alternate channel shall require no more than 250 milliseconds.

3.10.7 Continuous Data Recording - CDR data will be stored on replaceable disc packs. Data collection shall not require the replacement of a disc pack more than once per eight hour shift under the following conditions:

(a) An average traffic load of 150 aircraft (90 beacon and 60 search, of which 120 total are controlled)

(b) Extraction of the following data types:

1. Radar Target Reports

2. Correlated Radar and Beacon Target Reports

3. Tracking data

4. Automatic Functions

5. Manually Entered Functions (keyboard)

6. Interfacility Input and Output Data

7. System Utilization Data

8. Sector Time

The CDR function shall not exceed 10% of the total utilization of a single IOP under the above traffic load and types of data being extracted, without the loss of degradation of any of that data being extracted.

3.11 System Site Installation and Checkout

3.11.1 Pre-installation Planning - The contractor shall conduct an on-site inspection to become familiar with the environment that will be encountered during installation and checkout of the New York TRACON System.

Government representation will be available during this site inspection. Copies of drawings covering floor plan layouts, AC power, duct or overhead ladder installations of the control and equipment rooms of the site will be made available to the contractor during this inspection.

3.11.1.1 Installation Planning Report - The information contained in this report will be used by FAA field organizations and the New York TRACON to prepare the site for system delivery and follow-on installation and checkout activities. As a minimum, the report shall contain the following general and typical information:

(a) System block diagram with a short narrative general description of the functional capabilities and hardware subsystems.

(b) Typical floor plan layouts for control and equipment rooms. Information on equipment placement limitations, e.g., maximum distances between equipment comprising the system or new equipments already in place, shall be included.

(c) Detailed physical description of the equipment including physical size, weight, clearance factors, ventilation or air conditioning requirements, cable entry and exit features, etc.

(d) Cable and duct/overhead ladder requirements. This section shall include such items as information on subsystem cable interconnection requirements, system cable connections to existing equipment and type and quantity of cables to be used.

(e) Power requirements. Information on size and type of power cabling to be used, type and size of required Government furnished power panels, and circuit breaker requirements shall be included.

(f) System and equipment grounding requirements shall be stated.

(g) Any other technical or general information that will be required for Government field organizations in order to properly prepare the site for installation activities and which should be considered for proper installation, operation and maintenance of the equipment.

3.11.1.2 Government Prepared Preliminary Installation Plan - Based on the contractor prepared installation planning report, the Government will prepare a preliminary installation plan and submit this to the contractor for review. This preliminary plan will cover such items as:

(a) Floor plan drawings showing each piece of

equiment in the equipment rooms and all signal cable ladders and/or ductwork for signal cables between equipments.

(b) Cable routing diagram or cable routing information showing proposed cable routing and estimated length of cable runs between equipment.

(c) Power distribution diagram showing the circuit breakers and sizes to be installed for each piece of equipment as specified in the planning report.

(d) A system grounding diagram showing the various ground cables that are to be installed and connected to the equipment as specified in the planning report.

(e) Equipment delivery information such as elevators, ramps, doorways, hallways, etc.

(f) Any other general information mutually agreed to between the Government and the contrator.

This preliminary installation plan will be submitted six months prior to scheduled system delivery at the site to permit contractor review and still allow a minimum of five months for actual site preparation work.

Prior to actual site preparation work, the contractor shall inspect the site and review with the designated FAA representative all installation and site preparation plans to ensure that it conforms with contractor requirements. Cable length and other necessary installation materials shall be determined by the contractor during this site survey.

An inspection of the prepared site shall be made by the contractor 10 days pricr to equipment delivery. A representative of the Government shall be on site at this time. During this visit, the contractor shall check all site preparation work perfcrmed and determine if any additional tasks are required prior to equipment

delivery.

3.11.2 Installation and Checkout - The contractor shall provide a plan for the installation, testing, and acceptance of the hardware and software required to implement the functions described in this specification. This activity shall be conducted prior to Government cutover activity.

3.11.2.1 Requirements - The installation and checkout task shall be planned to cause no disruption of operations in the present New York Common IFR Room and in the towers which are to be interconnected with the New York TRACON. Tests requiring disruption to the Common IFR Room shall be coordinated with the Government (Region) for approval prior to implementation of tests.

Specifically, the contractor shall include in the installation plan suggested procedures for the following tasks:

1. Installation, integration, and testing of new ATCT equipment with Government installed operational BRITE displays.

2. Integration and testing of the New York TRACON system with video inputs from Government installed operational sensors at John F. Kennedy Airport and Newark International Airport which provide inputs to the New York Common IFR Room.

3.12 Documentation - The contractor shall provide all necessary services and material to develop and deliver supplementary ARTS IIIA documentation applicable to the unique requirements of the New York TRACON. These shall be delivered in the quantities and at the times specified by the contract schedule.

3.12.1 System Design Data - The design data submission shall be organized to reflect the contractor's approach to the total system design. This submission of design data shall not be used to produce modifications or alternatives to details of this specification or a

change in the scope of the contract. The design data shall include all elements of the equipment to be supplied by the contractor under the terms of the contract, as detailed by this specification and any addenda thereto, together with all interfaces with other equipment. A summary of equipment operational characteristics shall be included.

3.12.1.1 Block Diagram - A complete set of equipment block diagrams shall be provided by the contractor. The block diagrams shall show the general operational, electrical, and physical relationships of the equipment elements.

3.12.1.2 Information Logic Flow Diagrams - The contractor shall provide complete equipment information logic flow diagrams. These diagrams shall show the detailed logical, operational and functional relationships of the equipment elements. Symbology used in these diagrams shall be fully explained in the basic document.

3.12.1.3 Input/Output Details - The contractor shall provide data which consolidates all equipment interfaces and input/output characteristics. This shall include: transmission line characteristics, signal characteristics and limits, timing diagrams, message structure and formats, and power requirements. This data shall include all major intra-system as well as external system interfaces.

3.12.1.4 Computer Program Design Data - A complete document of the program organization and design data, subprogram description, external data formats, and internal data formats shall be furnished. This document shall provide overall information about the total computer program. The design data shall indicate the partitioning of the functional requirements into logically related subsets, which are identified with specific subprograms. For each subprogram, a discussion of performance requirements, including estimates of program timing and core storage requirements shall be provided.

3.12.2 Software Documentation - The contractor shall

provide operational and support program coding specifications, computer program functional specifications and operator manuals.

3.12.2.1 Program Coding Specifications - The program coding specifications shall include detailed descriptions of the program operations for all program and subprogram paths, descriptions of all tables including formats, program listings and flow charts in sufficient detail to permit modifications to the program by appropriately trained Government personnel.

3.12.2.2 Computer Program Functional Specifications (CPFS) - The contractor shall provide a complete set of CPFSs similar in detail and content to the CPFSs which exist for the current ARTS III BTL system (NAS-MD-602 through NAS-MD-613). A preliminary set of CPFSs shall be provided at the time of submission of the system design data.

3.12.2.3 Operator Manuals - The contractor shall provide operator manuals which include detailed descriptions of operating controls in the data processing subsystem, start/restart instructions for the software, instructions for gaining access to any part of the software, use of the assembler, use of software debug modules, and any other data relevant to operation and checkout of the software.

3.12.3 Test Documentation

3.12.3.1 Test Plan - The contractor shall provide a recommended test plan for both factory and site tests at the module, subsystem and system levels for review and approval by the Government. The objective of this plan will be to show how the contractor will demonstrate compliance with the performance requirements of this specification. The Government will review, approve, and/or direct necessary changes to the test plan as specified in the contract. the contractor shall incorporate such changes and resubmit the final test plan 60 days prior to any equipment tests.

3.12.3.1.1 Test Plan(s) Content - The test plan(s)

shall be comprehensive, including all details necessary to assure that test procedures and testing will satisfactorily demonstrate equipment software, subsystem and system compliance with all requirements specified herein.

The test plan(s) shall include, as a minimum the test description and its purpose. The description shall include a block diagram showing the system configuration and interfaces, the basic test approach and a description of what is to be tested.

The test plan shall provide the information required for subsequent preparation of the test procedures.

3.12.3.1.2 Test Schedule - The test plan shall contain a contractor proposed schedule for each test. The Government reserves the right to witness any or all tests conducted in accordance with the approved test plan.

3.12.3.1.3 Test Plan Amendments - If, during a test, the test methods or parameters, as agreed to by the Government, are found to be inadequately specified, they shall be amended by the contractor and further approval by the Government obtained.

3.12.3.2 Test Procedures - The contractor shall provide all test procedures and/or scripts to be used during the conduct of a test. These procedures shall include all test record forms to be used as test data sheets, test operator logs, and reports. The test procedures in addition shall include:

(a) Designation of all inputs that are required to test each function.

(b) Test output records including a description of required outputs, the types of equipment used to observe or provide the outputs, etc.

(c) A complete time sequenced schedule of events.

(d) A list and description of each software program to be used, including the total

running time for each program. The description shall include the format and contents of each type of message output and of any printouts or records to be maintained.

(e) A detailed description of analysis or combination of analysis and test results which may be offered in lieu of testing, where complete test results may be difficult or impractical to obtain.

These documents shall be provided by the contractor and submitted for review 30 days prior to the scheduled performance of a test as specified in the contract.

3.12.3.3 Test Reports - Upon conducting the applicable tests in accordance with the approved test plan, the results shall be recorded for submission to the FAA.

The test report shall contain a complete description of the test results and as a minimum, contain the information specified below:

(a) Indicate the performance of each equipment under test and whether it meets the system limits.

(b) Functions that were tested.

(c) Information as to whether the results of the test are in agreement with the required reliability of the unit or system.

(d) The quantity and type of spare parts needed to correct the errors or malfunctions.

(e) A record of any engineering changes found necessary to correct design deficiencies.

3.12.4 Index of Drawings and Technical Memoranda - The contractor shall maintain an index of all drawings and technical memoranda produced in connection with design, fabrication and test of the system. This index shall be updated monthly and copies shall be submitted to the FAA as specified in the contract.

3.12.5 Maintenance Instruction Manuals - The contractor shall provide maintenance instruction manuals of sufficient depth to permit FAA maintenance and operation of the equipment. These manuals shall include theory of operation, operating instructions, maintenance instructions (including a complete set of block and schematic diagrams), circuit diagrams, parts and test equipment list and instructions for running and evaluating the results of diagnostic, maintenance and test software. The manuals shall be provided in accordance with FAA-D-2494, as modified by Appendix A, except that the parts list shall be in accordance with FAA-G-1310C. Engineering drawings shall be in accordance with FAA-STD-002, with Amendment 1. Engineering logic diagrams shall be in accordance with FAA-STD-010a.

3.12.6 Progress Reports - The contractor shall provide periodic progress reports as defined and scheduled in the contract.

4. QUALITY ASSURANCE PROVISIONS - The contractor shall establish and maintain a quality control program in accordance with FAA-STD-013a. The quality assurance provisions specified in Section 1-4 of FAA-G-2100/1 form a part of this specification unless otherwise noted. The following levels of inspection and testing are applicable to all systems and shall be conducted in accordance with requirements put forth in the contract.

Records of tests, including examinations and inspections shall be kept complete and available to the Government. All tests and inspections shall be performed by the contractor. The Government, however, reserves the right to witness or perform any of the test or inspections required. The Government reserves the right to subject all tests and inspections to Government approval by FAA inspectors. The Government also reserves the right to waive the requirements of any portion of the inspections and tests. All tests shall be conducted in accordance with test methods and procedures stated in the Government approved test plan.

The contractor shall be responsible for conducting all required tests. Whenever testing is scheduled, the

contractor shall ascertain that the test scripts and test data sheets have been distributed, and that the test area has been cleared of all equipment parts, and components, not required for the subject test. All the test personnel shall normally be provided by the contractor. However, the FAA reserves the right to use FAA personnel in lieu of contractor personnel to man any operating position in the equipment configuration under test. The contractor shall make any and all additional tests necessary to demonstrate compliance to the required system performance. If during the course of any tests, errors or malfunctions occur, the contractor shall file the appropriate forms and make entries in the appropriate logs. In addition, the contractor shall document each error or malfunction indicating the type, the procedures taken, the time required to correct and make the error assignment to the appropriate equipment or software element.

The contractor shall be responsible for incorporating and testing any modification to his design found necessary during the testing of the equipments. No design changes or modifications will be allowed to the equipment under test without the approval of the designated FAA representative. If any changes are found to be necessary, the Government reserves the right to require any completed tests to be rerun to verify that no adverse effects result from the change. Failure during testing shall be recorded in accordance with the Equipment Failure Handbook 6040.10. Maintenance logs shall utilize FAA Form 6030 and be filled out per Order SM 6030.36A. The FAA may require the contractor to repeat tests, or portions thereof, if the original tests fail to demonstrate compliance with the specification.

Two major categories of tests are required: design verification tests which are conducted on selected units, subsystems and systems and acceptance tests which are conducted on all units, subsystems and systems.

4.1 Design Verification Tests - The contractor shall conduct design tests to demonstrate that the requirements of this specification have been met.

These tests shall be conducted in the factory or at a government approved test facility or some combination thereof. Where design test results are available from testing of identical components or groups of components used in other systems, these results may be used in lieu of actual testing of those components for the New York TRACON System.

Design Verification testing shall consist of:

(a) Unit Tests

(b) Subsystem Tests

(c) System Tests

(d) Reliability Tests

(e) Maintainability Tests

(f) Environmental Tests

4.1.1 Unit Tests - The contractor shall conduct unit tests to verify that each individual piece of hardware meets the performance requirements as specified herein and in FAA-E-2591a. These tests shall be conducted on one unit of each hardware type. Unit tests shall include, but not be limited to, first article inspection.

4.1.2 Subsystem Tests - Subsystem tests are tests of equipment combinations and/or equipment and software combinations. The contractor shall conduct such tests on those subsystems identified in the contract to verify proper operation of the subsystems and to provide confidence that the system tests will have a high probability of success.

4.1.3 System Tests - The contractor shall conduct system tests to verify that all performance requirements of this specification have been met. These tests shall be designated to exercise the total system including the operational software. Video inputs shall be used.

As part of this test system response times and capacity shall be measured.

4.1.3.1 Confidence/Stability Test - As part of the system test, a continuous confidence/stability test shall be performed using video inputs with the operational program running. Manual inputs from the display data entry devices shall also be used. Measurements shall be made at the beginning of the test and at specified intervals which shall be indicative of the stability of the system. All system adjustments shall be made prior to the start of the test and no further adjustments will be allowed for the duration of the test. During the last half-hour of the test, a simulated power failure test shall be made. This test shall be made by interrupting all AC power to the system for a period of at least 15 seconds. When power is restored, all malfunctions or errors shall be recorded. The test shall be resumed without any equipment adjustments. If manual adjustments or intervention is required to re-initiate operation, these shall be fully documented in the test report. The contractor shall include in his test plan the proposed pass/fail criteria to be used and his recommendation on the length of time the test should run (minimum of 72 hours is required).

4.1.4 Reliability Demonstration Testing - The contractor shall perform a reliability demonstration test on those units not previously tested to MIL-STD-781. The test shall be performed using the reliability requirements specified in 3.8 to derive the basic accept/reject criteria. The reliability demonstration shall be performed in accordance with Test Plan XXV of MIL-STD-781. Preventive maintenance tasks, where required tc be accomplished during the reliability demonstration, shall meet the requirements of Section 3.8 and Paragraph 4.1.5. These test results hall be used to calculate the TRACON system reliability performances.

4.1.5 Maintainability Tests - The contractor shall develop corrective maintenance demonstration plans in accordance with MIL-STD-471, except as modified herein. The task selections shall be outlined in Appendix A of

MIL-STD-471. The statistical corrective maintenance demonstration tasks shall have failure modes based on information from the Failure Modes and Effects Analysis from Section 3.8 of this specification. Method 1, Plan A1 of MIL-STD-471 shall be employed by the contractor for corrective maintenance tasks in accordance with the procedure outlined in Appendix A of MIL-STD-471. The Government will randomly select 50 of these tasks for the statistical corrective maintenance demonstration. The mean corrective maintenance down-time shall be no more than the mean corrective maintenance down-time (MTTR) specified in Section 3.8. during the corrective maintenance demonstration any real equipment failure shall be corrected. Such a failure shall be timed and counted as part of the demonstration.

4.1.5.1 Preventive Maintenance Demonstration Tasks - Each preventive maintenance task shall be performed during the preventive maintenance demonstration. The time to perform these tasks shall not exceed that permitted by Section 3.8 of this specification. Equipment required for operational (on-line) use shall not be pre-empted for preventive maintenance, nor shall preventive maintenance be performed on equipment which is in use in the on-line system. The ability to perform preventive maintenance without degrading system performance shall be demonstrated.

4.1.6 Environmental Tests - The contractor shall conduct environmental tests on all equipments to verify that these equipments can meet the environmental requirements specified in Sections 3.11.3.11, 3.11.3.11.1, and 3.11.3.11.2 of FAA-TD/S/120-801A (Salt atmosphere test is not required).

4.2 Acceptance Tests - The contractor shall conduct acceptance tests on all units, subsystems, and the system that is delivered to the government. Acceptance tests are a combination of factory and site tests.

4.2.1 Factory Tests - Factory tests are those unit and subsystem tests conducted within the contractors plant to ensure that each unit, subsystem, and system meets the requirements of this specification prior to delivery.

4.2.1.1 Factory Inspection- The quality assurance provisions specified in FAA-G-2100 and MIL-I-45208A form a part of this specification and shall be complied with. All inspections and tests at the contractor's plant shall be performed by the contractor, and may be witnessed, and subject to approval by FAA inspectors. The government reserves the right to waive the requirements of any portion of the inspections and tests.

4.2.1.2 Incoming Inspection - The government may elect to witness incoming inspection of all or any portion of the components and materials used in construction of the equipment to determine compliance with the specifications covering component procurement.

4.2.1.3 Unit Inspection - Each completed unit supplied as an integral part (or spare unit) of the system under the contract shall be given a mechanical and electrical examination. The mechanical examination shall be used to determine compliance with the applicable specifications covering fabrication requirements such as strength and rigidity, accessibility, type of components and materials, choice of insulation, layout of chassis, panel, and wiring finish and making. The contractor shall perform an electrical inspection to determine compliance with the applicable specifications covering electrical continuity, leakage resistance, power supply voltages and regulation, signal to noise ratio, pulse and wave shapes, resolution, and storage characteristics.

Units built, tested, and approved in accordance with the applicable specifications may be retained temporarily by the contractor in order to facilitate testing of associated units. However, such units used for test purposes shall be given a mechanical and electrical re-inspection prior to government acceptance if required by the contracting officer.

4.2.1.4 Subsystem Tests - Prior to integration into the system, subsystems shall be tested to determine compliance with the functional requirements of this specification.

4.2.1.5 Operational System Tests - The system shall be functionally tested with the operational software prior to delivery using real or simulated inputs. Compliance with all system performance requirements shall be verified. The tests shall be designed to insure a high degree of confidence in the proper operation of the system when installed at the site.

4.2.2 Site Tests Site tests shall be conducted at the unit, the subsystem and system level consistent with the installation and checkup plan (see Section 3.11). Each site test shall be designed to meet the following objectives:

(a) To verify that the installed unit, subsystem or system meets the performance requirements of this specification.

(b) To provide the required certification procedures to enable the FAA to operate with the installed unit, subsystem, or system.

These tests shall be conducted in three stages in accordance with the government-approved installation plan:

(a) Stage 1 - Stage one shall verify system integrity prior to interfacing with any site equipment. Stage one must be successfully completed before Stage two can be started.

(b) Stage 2 - Stage two shall be an integrated test to be conducted after the system is integrated with the site facilities. To minimize interference with the normal operations at the remote ATCT's and the existing New York Common IFR Room, this test shall be conducted with the required number of displays in a test bed configuration.

(c) Stage 3 - This stage shall use all operational displays to demonstrate complete site adaption. During this test all functions and combinations of functions such as keyboard and trackball data entry,

tracking and display processing, shall be exercised to show conformance with each of the system operating requirements.

4.3 Test Conduct - The contractor shall be responsible for conducting all required tests. Whenever testing is scheduled, the contractor shall ascertain that all necessary personnel are available, that contractor provided procedures, test scripts, and test data sheets have been distributed, and that the test area has been cleared of all equipment parts, components, etc. not required for the subject test. All test personnel shall normally be provided by the contractor. However, the FAA reserves the right to use FAA personnel in lieu of contractor personnel to man any operating position in the equipment configuration under test. The contractor shall conduct a test briefing and debriefing for each test and shall assure that all personnel have been properly instructed in their duties. The contractor shall make any and all additional tests necessary to demonstrate compliance to the required system performance. If, during the course of any tests, errors or malfunctions occur, the contractor shall file the appropriate forms and make entries in the appropriate logs. In addition, the contractor shall document each error or malfunction indicating the type, the procedures taken, the time required to correct and make the error assignment to the appropriate equipment or software element.

4.3.1 Failure Accountability - There are two major classes of failure: relevant (countable) failures and non-relevant (non- countable) failures.

Relevant failures are defined as:

(a) Manufacturing defects

(b) Parts defects

(c) Design defects

(d) Unknown

Failures due to other causes shall be classified

non-relevant. This class includes failures due to:

(a) Accident of mishandling

(b) Operator (where not due to improper design)

(c) Failure of part not supplied by the contractor

(d) Test equipment or facility failure

(e) Installation error

The burden shall be on the contractor to show that a failure should be classified non-relevant.

4.3.1.1 Failure Recording and Reporting - Failures shall be recorded in accordance with the Equipment Failure Handbook 6040.10. Maintenance logs shall utilize FAA Form 6030-1.

4.3.1.2 Additional Tests - The FAA may require the contractor to repeat tests, or portions thereof, if the original tests fail to demonstrate compliance with the specification.

4.3.1.3 Problem Areas - The contractor shall be responsible for solving problems encountered in providing the system to the requirements of this document. He shall nofity the FAA promptly of any problems beyond his jurisdiction.

4.3.1.4 Equipment Module or Subsystem Modification - The contractor shall be responsible for incorporating and testing any modifications to the design necessary to meet specification requirements. Resulting modifications to equipment shall be incorporated into each unit delivered at no additional cost to the Government.

4.3.1.5 Documentation Updating - The contractor shall update the system documentation of block diagrams, electrical and mechanical drawings, installation drawings, part lists, wire lists, logic flow charts and diagrams, computer programs and flow charts, and all associated descriptive materials. The updating shall be accomplished periodically to maintain the above described documentation in current status. Updated drawings shall be prepared in accordance with the drawing standards specified in Graphic Symbols for Digital Diagrams (FAA-STD-010a). All copies of

obsolete and voided documents shall be so marked and disposition shall be made in accordance with FAA instructions.

5.0 PREPARATION FOR SHIPMENT - All equipment and spares shall be prepared for shipment and shipped in accordance with MIL-STD-17555, Method 3 unless air ride padded shipment is used. Shipment shall be in accordance with the contract requirements.

6.0 NOTES

6.1 Note on Information Items - The contents of this Section 6 are only for the information of the initiator of the procurement request and are not a part of the requirements of this specification. They are not contract requirements nor binding on either the Government or the contractor. In order for these terms to become a part of the resulting contract, they must be specifically incorporated in the schedule of the contract. Any reliance placed by the contractor on the information in these subparagraphs is wholly at the contractor's own risk.

6.2 Intended Use - The equipment specified herein is intended for use at the New York TRACON facility to provide Air Traffic Control essential to the safety of aircraft departing from and arriving at airports within the greater New York metropolitan area.

6.3 Outline Design - Figure 6-1 is a block diagram of a typical configuration but is not a requirement of this specification. This drawing is furnished only as a matter of information to the contractor, to assist him in visualizing a typical design. The Government does not represent or guarantee that conformance thereto will insure that the resulting product will meet specification requirements. Any reliance which the contractor places on figure 6-1 is wholly at his own risk and shall not relieve him of his contractural obligation to comply with all of the requirements of this specification.

* * * * * * * * * * *

Table of Contents Refer to pages 119 through 122

Glossary Refer to pages 123 through 127

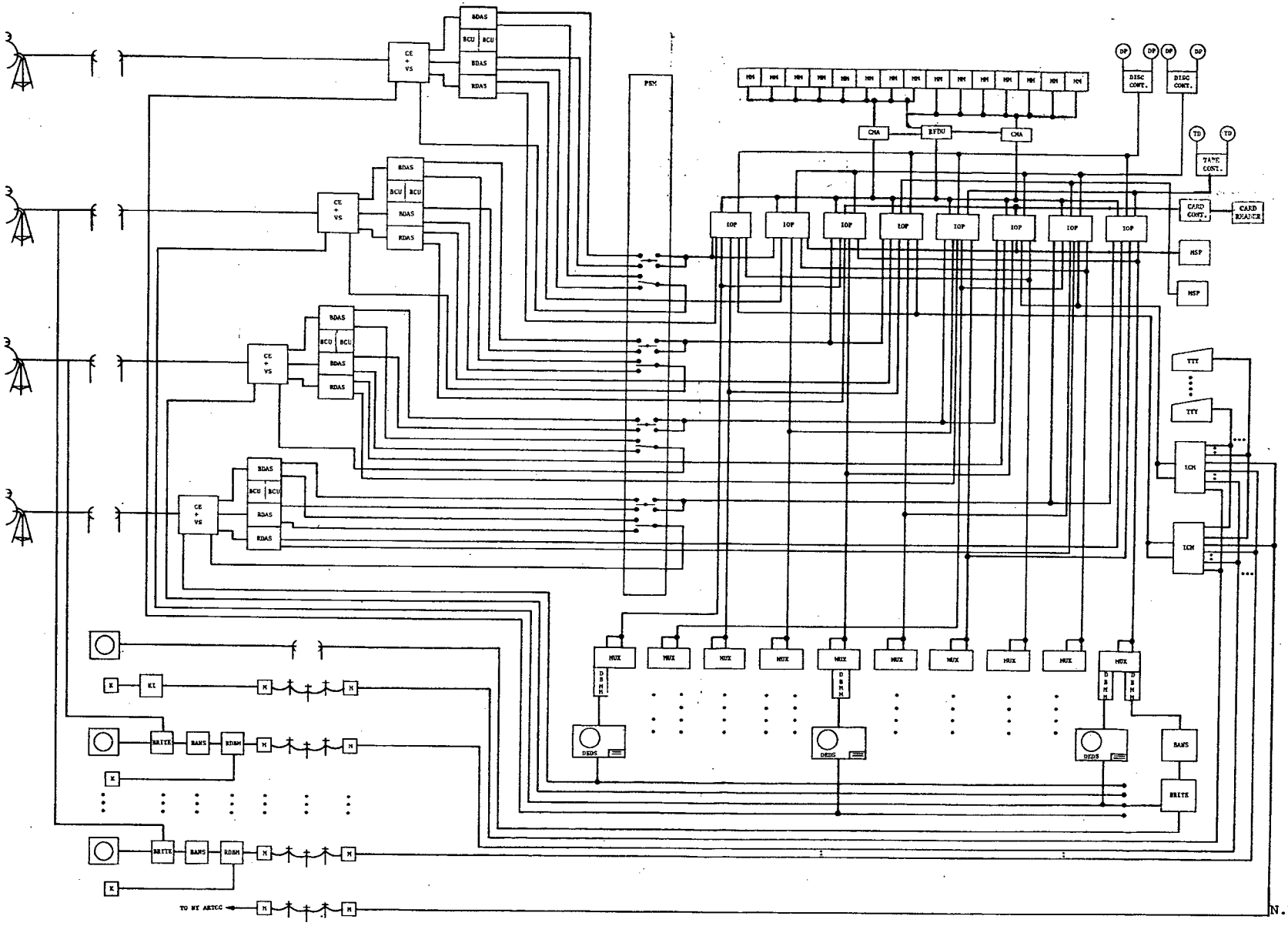

FIGURE 6-1
N.Y. TRACON REPRESENTATION

TABLE OF CONTENTS

GLOSSARY

The following is a list of terms and acronyms. A comprehensive listing of terms and abbreviations which may be applicable is contained in NAS-MD-310.

ABC	Assigned Beacon Code
AC	Alternating Current
ACID	Aircraft Identification
ACP	Azimuth Change Pulse
APG	Azimuth Pulse Generator
ARP	Azimuth Reference Pulse
ARTCC	Air Route Traffic Control Center
ARTG	Azimuth and Range Timing Group
ARTS	Automated Radar Terminal System
ASR	Airport Surveillance Radar
ATCBI	Air Traffic Control Beacon Interrogator
ATCT	Air Traffic Control Tower
ATIS	Automatic Terminal Information Service
BANS	BRITE Alpha-numeric Subsystem
BCN	Beacon
BCU	Beacon Control Unit
BDAS	Beacon Data Acquisition Subsystem
BIP	Beacon Input Processing
BOT	Beginning of Tape

BRG	Beacon Reply Group
BRITE	Bright Radar Indicator Tower Equipment
BTL	Beacon Tracking Level
BUP	Builder Utility Program
CDR	Continuous Data Recording
CMA	Central Memory Access
CPFS	Computer Program Functional Specification
CTA	Console Typewriter Adapter
CTS	Central Track Store
DABS	Discrete Address Beacon System
DBMM	Display Buffer Memory Module
DC	Direct Current
DEDS	Data Entry and Display Subsystem
DPS	Data Processing Subsystem
DSG	Digital Sweep Generator
EEM	Electronic Equipment Modification
EM	Emergency
ESR	Executive Service Request
ETG	Enhanced Target Generator
EWR	Newark International Airport
FAA	Federal Aviation Administration
FDB	Full Data Block
FMECA	Failure Modes, Effects and Criticality

	Analysis
FP	Flight Plan
GFE	Government Furnished Equipment
GSI	General Systems Information
HJ	Highjack
HPN	Westchester County Airport
HSP	High Speed Printer
IC	Initiate Control
ICA	Interfacility Communications Adapter
ICCU	Intercomputer Control Unit
ICM	Interfacility Comuniations Multiplexor
ID	Indentification
IFR	Instrument Flight Rules
IMT	Integral Magnetic Tape
I/O	Inout/Output
IOP	Input/Output Processor
ISP	Islip MacArthur Airport
JFK	John F. Kennedy International Airport
LDB	Iimited Data Block
MDBM	Multiplexed Display Buffer Memory
MM	Memory Module
MODEM	Modulator-Demodulator
MSP	Medium Speed Printer

MSS	Mass Storage Subsystem
MTBF	Mean Time Between Failures
MTI	Moving Target Indicator
MTTR	Mean Time tc Repair
MUT	Mean Up Time
MUX	Multiplexor
NAS	National Airspace System
NDRO	Non-destructive Read Only
NYCIFRR	New York Common Instrument Flight Rule Room
PERT	Program Evaluation and Review Technique
POFA	Programmed Operational Functional Analysis
PRF	Pulse Repetition Frequency
RT&BTL	Radar Tracking & Beacon Tracking Level
RDAS	Radar Data Acquisition Subsystem
RDBM	Remote Display Buffer Memory
RF	Radio Failure
RIP	Radar Input Processing
RMA	Reliability-Maintainability-Availability
RML	Radar Microwave Link
RSL	Recovery System Library
RTDA	Remote Tower Display Adapter
RTDS	Remote Tower Display Subsystem
RTQC	Real Time Quality Control

SA	Suspect Aircraft
SCP	System Configuration Panel
SDP	System Diagnostic Program
SP	System Parameter
SPI	Special Position Indicator
TC	Terminate Control
TOS	Track-oriented Smoothing
TIMER	Operational Program Timing Routine
TTA	Teletype Adapter
USASCII	United States American Standards Code for Information Interchange
VFR	Visual Flight Rules
XEF	Increment Refresh Rate Hit Counter

☆ U.S. GOVERNMENT PRINTING OFFICE: 1976-211-173/723